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ABSTRACT

This report aims to provide an answer to the question of whether there is an economic justification for public intervention to improve the quality of nonparental child care, especially for lower income families. Evidence from large- and small-scale studies of the effects of child care on children's development is presented, and the economic rationale that emerges from that evidence is outlined. Nonparental child care is now the norm for young children in the United States, with nearly 60% of children 5 years or younger in child care on a daily basis. Taking into account both the gender of the child and family factors, researchers find that children appear happier, have closer and more secure attachments to caregivers, and perform better on standardized cognitive and language tests in settings with higher process quality. These are settings with developmentally appropriate activities and caretakers who are emotionally supportive and responsive to their needs. Longer-term associations between process quality and children's developmental outcomes have also been studied. One of these studies was the National Institute of Child Health and Human Development Study of Early Child Care, which found that process quality during the child's first 3 years was related to the preacademic skills of expressive language and receptive language at age 3. The same study found that child care was often only fair in quality, with only 11% of settings judged excellent. From the point of view of an economist, the clear evidence of market failure in the child care sector warrants a need for public-sector intervention. The benefits of high quality child care accrue not only to the child, but to other members of society, including all children in schools with children who attended day care, taxpayers, and citizens who gain through reduced crime and public assistance costs. (Contains 8 figures, 13 tables, and 134 references.) (SLD)

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Child Care Quality: Does It Matter and Does It Need to be Improved?

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Executive Summary

This report aims to provide an answer to an important policy question: Is there an economic justification for public intervention to improve the quality of nonparental child care, especially for children from lower-income families? The bulk of the evidence argues that the answer is yes. In this report we adduce evidence from large- and small-scale studies of the effects of child care on children's development, and set out the economic rationale that emerges from that evidence.

Nonparental child care is now the norm for young children in the United States. Nearly 60 percent of children 5 years or younger are in child care on a regular basis, and 44 percent of infants are in child care for more than 30 hours a week (1). With the implementation of welfare-to-work programs in nearly all states, use of nonparental care is extending ever more widely among low-income families. To assess the effects of this sea-change in child-rearing upon children, upon families, and upon society as a whole, we must begin with some quite specific questions: Does the quality of child care have meaningful effects on children's developmental outcomes and on the employment of mothers, traditionally the primary caretakers? What is the quality of child care in the United States? How could it be improved, and what might be the cost of doing so?

Does the Quality of Child Care Have Meaningful Effects on Children's Developmental Outcomes?

An established view among child care researchers is that higher-quality care is associated with better developmental outcomes, and lower-quality care with poorer developmental outcomes (2,3). Some researchers, however, have recently argued that widely varying qualities of care have little or no meaningful effects on children's development (4,5). A major goal of the current report is to critically evaluate the research evidence from which these divergent conclusions have been drawn.

The quality of child care has been measured in two main ways. The first is by observing what actually occurs in child care settings—children's interactions with caregivers and other children, particular activities such as language stimulation, and health and safety measures. These features are described as indicators of *process quality*, which is scored by widely accepted rating scales. The second set of indicators includes the *structural characteristics* of the child care setting and the quality of the caregivers. These include, for example, the child:adult ratio, the size of each group of children, and the formal education and training of the caregivers.

These two sets of indicators are consistently related. When child:adult ratios are lower, children generally appear less apathetic and distressed; caregivers spend less time in managing their classrooms and offer more stimulating, supportive care. When staff is more highly trained and better compensated, children's activities are of higher quality, and caregivers are more responsive and less restrictive. Higher-quality settings are likely to have better health and safety practices, resulting in fewer respiratory and other infections among the children, and have fewer playground injuries. (7–17)

Concurrent Associations

Research yields first-hand evidence about children's responses to child care of varying quality, at the time they are in care. In the short term, process and structural quality are both important. Taking into account both the gender of the child and family factors, researchers find that children appear happier, have closer and more secure attachments to caregivers, and perform better on standardized cognitive and language tests in settings with higher process quality, that is, settings with developmentally appropriate activities and caregivers who are emotionally supportive and responsive to their needs. (13, 18–27) In contrast, poor process quality appears to predict heightened behavior problems (26, 28).

Both correlational and quasi-experimental research has found relations between structural quality and child performance. For example, children in classrooms with lower child:adult ratios were better able to understand, initiate, and participate in conversations, had better general knowledge, were more cooperative, and in their interactions with each other showed much less hostility and conflict than in settings where there were more children to each adult. On average, preschoolers perform better on standardized cognitive tests when their caregivers are better educated and trained—for example, if they have at least an associate arts degree in a child-related field. The children also have better language skills, are more persistent in completing tasks, and in general are more ready for school. (29–32)

Longer-Term Associations

Longer-run associations between process quality and children's developmental outcomes also have been studied. Several of these studies are methodologically strong, in that they included controls for family selection differences and they assessed child care quality over time rather than rely on a single, possibly nonrepresentative assessment (9, 33, 34). The National Institute of Child Health and Human Development (NICHD) Study of Early Child Care has found that process quality during the first three years was related to children's preacademic skills of expressive language and receptive language at age 3, even after controlling for particular child and family characteristics. The Cost, Quality, and Outcomes Study reports that children enrolled in higher-quality child care classrooms as preschoolers displayed better math skills through second grade, and the effect was greater for the children of less-educated mothers (the differential effects on language skills were less persistent). Children whose caregivers were more involved and invested in them during the preschool years had fewer behavior problems, according to their kindergarten teachers (35).

The NICHD study also has asked whether the measured associations were large enough to be meaningful. To address this issue, researchers conducted a parallel analysis of the relations between the quality of the home environment and children's developmental outcomes. Their results—showing that effects associated with the quality of the home were roughly twice the size of those associated with the quality of the child care—suggest that the effects of child care process quality for three-year-olds are both statistically significant and meaningful, but by no means as important as the family for young children (36,37,38) .

Other dissenting studies have found little or no relation between child care quality and children's development over the longer term (4, 40, 41). These studies, however, tended to use less reliable indicators, such as maternal reports of caregiver training or single observations of child care quality obtained at one point in time. But child care arrangements are typically not stable, and over half of the children in these studies had seen more than three changes in their child care during the intervening period. Stronger, more valid tests of the effects of child care quality require reliable and valid measures over time.

An Economist's Interpretation of the Link between Child Care Quality and Child Outcomes

The studies discussed above used the hierarchical regression models traditionally employed by developmental psychologists. These findings were converted into statistical terms more familiar to economists, thus allowing us to estimate how great a change we might expect in children's developmental outcomes if the quality of child care were to be systematically improved. These analyses applied standard OLS regressions to data regarding children's cognitive and language development that were reported by the NICHD Study. (25)

Controlling for a variety of parental and other influences, we estimated how much improvement we might expect in children aged 15, 24, and 36 months if measures of caregivers' quality and language stimulation improved from one standard deviation *below* the mean level of quality to one standard deviation *above*. We find statistically significant improvements (see Tables 7 and 11 in the full study). For example, we estimate that a shift from the lowest rating to the highest rating for the caregiver would result in an improvement (relative to the mean) of about 50 percent in measures of children's school readiness, expressive language skill, and verbal comprehension. We also find that the cumulative impact of child care quality for 3-year-olds is significant and is rather greater than the concurrent impact, particularly for measures of language and vocabulary.

The Very Long-Term Effects of Some Early Childhood Interventions

A small cluster of early childhood interventions offer evidence of potentially powerful and long-lasting effects of enriched and intensive child care programs for low-income, "high-risk" preschool children, though they were not strictly "child care" per se. The best-known studies are the Carolina Abecedarian Project (42,43,44), the Perry Preschool Project (45), and the Chicago Child-Parent Centers (46). All have involved random-assignment, intensive evaluations, have followed participating children into early adulthood, and have examined such outcomes as educational achievement, earnings, criminal activity, and the use of cash welfare assistance.

Children in the Carolina Abecedarian Project evinced long-term gains in IQ scores, reading, and math. Age 21 follow-up reports showed that they were on average older at the time their first child was born and were more likely to have attended a four-year college than peers not in the program. By age 27, children in the Perry Preschool Project were less likely to have ever been arrested, had mean monthly earnings almost double those of control-group members—$1,219 versus $766—and were much less likely to be receiving public assistance—15 versus 32 percent. Children in the Chicago Child-Parent Centers study had significantly higher math and reading scores, and by age 20 were more likely to have completed high school and to have lower rates of juvenile criminal activity than children not in the program.

Child Care and Parental Employment

Existing studies linking employment and child care focused on affordability. Clearly, higher-quality care is likely to be more expensive, and a parent facing that choice may elect to forgo or limit employment (47,48). That is no longer an option for women in welfare-to-work programs.

There is only limited evidence on the relationship between child care quality and employment, but it suggests that among low-income women, higher-quality child care may increase the likelihood and stability of employment and hours or work (49) and improve mothers' later educational achievement (50, 51). Mothers in an intervention program providing center-based care for low-birthweight infants, the Infant Health and Development Program, were significantly more likely to be working than women in the control group, and the effect was greater for less-educated than for better-educated women (52).

There is complementary evidence of the negative effects of poor quality care on labor force participation. Nearly a third of teenage mothers participating in one experiment, the Teenage Parent Demonstration, reported that unsatisfactory quality of child care led them to stop working or to change hours or activities (53).

What Is the Quality of Care in the United States?

Is high-quality care the norm or the exception? Unfortunately, there are no nationally representative studies to help us answer this question, and we must rely upon suggestive data from multisite studies.

Process Quality

In the Cost, Quality, and Outcome Study (54), 398 centers in four states that varied in child care regulations were identified. Of the sites that were studied, 12 percent were rated "less than minimal" in quality and 15 percent "good." The remaining sites were rather evenly distributed between those two end points. This may represent a rather optimistic picture, for the sites that did not consent to the study seem likely to have offered lower-quality care. Only 52 percent of the sites consented to the observational studies.

Perhaps the best available estimate for children 3 years old and younger is provided by the NICHD Study of Early Child Care, which conducted observations of over 600 nonmaternal child care settings of all kinds (grandparents, in-home care, child care homes, and centers) in nine states (9). In this study care was most often judged to be only fair in quality; over all, only 11 percent of the settings were considered excellent. Poor-quality care was most likely in centers serving infants and toddlers (10 percent) than in centers serving older children (4 percent).

The NICHD investigators extrapolated their findings to the distribution of American families in the National Household Education Survey of 1995. Their estimate—8 percent of settings for children under 3 poor, 53 percent fair, 30 percent good, and 9 percent excellent in process quality—led them to conclude that care is neither outstanding nor terrible, but that plenty of room for improvement remains.

Structural and Caregiver Characteristics

Quality of child care in the United States can also be estimated by the degree of adherence to recommended guidelines in areas such as child:adult ratio and caregiver training. Very few states currently have child care regulations that meet the age-based guidelines established by such professional organizations as the American Academy of Pediatrics and the American Public Health Association (55). For example, only three states have standards as strict as the recommended 3:1 ratio for infants. Some states are at substantial odds with recommended standards. Eight states, for example, permit ratios of 6:1 for infants (see Table 10 of the report).

Nationally representative surveys also indicate that recommended standards for structural characteristics are often not met. The Profile of Child Care Settings (56) found that the average center and child care home had child:adult ratios that did not meet standards that are linked to positive developmental outcomes. In 1990, caregivers in centers, but not child care homes, did tend to be well-educated and trained. Nearly half had completed college, and 90 percent had received at least 10 hours of in-service training. Regulated home child care providers had less education and training: 34 percent had no schooling beyond high school and only about two-thirds had received any in-service training.

More recent data from the NICHD study suggests there has been some decline in the educational background and training of child care staff over the decade (Table 12 of the report). Just a little over half of infant and toddler caregivers had received specialized training during the preceding year and about two-

thirds had more than a high school degree. The decline may well be related to the generally low wages in the child care field, which have not improved over the 1990s. Teachers average between $13,125 and $18,988 for full-week, full-year employment, assistant teachers only $6.00–7.00 an hour. It is not surprising that turnover is high, with 20 percent of centers losing half or more of their staff in the course of a year (57).

Is There a Case for Public Investment in Quality Child Care?

Economists define market failure as "a situation in which a market left on its own fails to allocate resources efficiently." In the child care sector, there are two primary reasons for market failure. The first is lack of information. In part because the market is made up of small providers, it is difficult for parents to acquire information about the comparative quality, cost, and availability of care, and they are unsure how to evaluate the information they acquire. Considerations of convenience, time, and access mean that parents may limit their search to small geographic areas; these problems may be particularly acute for low-income families and for those who need care for odd-hours employment (58).

A second cause of market failure in the child care sector is what economists call "externalities" (effects beyond the primary consumers). The benefits of high-quality care accrue not just to the parent and the child but to society generally. They include lower costs for later schooling, as children enter school better prepared to achieve; future reductions in crime as juvenile delinquency diminishes; increased productivity and lower need for social services as working parents face fewer child-related absences or terminations and remain more securely attached to the labor market. The family and social costs of poor-quality, unsafe, and unhealthy child care are equally apparent.

To these major causes of market failure, we may add a third—an "imperfect capital market." Parents of young children tend to have low incomes relative to their permanent incomes, and may face borrowing constraints that reduce their ability to pay for high-quality care.

When markets fail, public-sector intervention may improve the performance of that sector of the economy. Such intervention may also be justified by the goal of equality of opportunity. If high-quality child care improves cognitive ability, school readiness, and social behavior, children in low-income families should be given the same opportunity to benefit as children in high-income families. To accomplish this, government subsidies or direct provision of care are necessary.

Research tells us that difficulty in obtaining high-quality care above all affects low-income families, especially those with intermittent work or nontraditional work hours. One-third of working-poor mothers (incomes below poverty) and more than a quarter of working-class mothers (incomes below $25,000) work weekends, and half of working-poor parents work on a rotating schedule, yet only 10 percent of centers and 6 percent of family day care homes provide weekend care. As a result, such parents are more likely to rely on a patchwork of providers, including flexible and often unstable arrangements with relatives, friends, and neighbors (59,60). Lack of stability is itself a measure of poor-quality care.

Thus market failure perpetuates itself. Because the demand for high-quality care is too low, compensation is too low, and the more highly trained seek employment in other spheres. As a result, quality declines, *unless intervention occurs*. We believe that the compelling social arguments that justify the role of government in providing or subsidizing schooling from the elementary grades through college are equally applicable to the first five years. Many of the benefits of child care are like those of primary schooling—child care is, at its best, early childhood education. Just as primary schooling prepares children

for secondary schooling, so good child care readies children for primary schooling. The community at large benefits from the cognitive, linguistic, and behavioral competencies that are associated with higher-quality child care.

A variety of public-sector interventions may be used to improve child care. They include the provision of information, licensing requirements, placement activities, financial incentives, and training programs for child care workers, tuition subsidies and tax credits for parents, incentives for employer-provided care, and direct provision of care. At a minimum, the public sector should provide information on available child care slots, hours of operation, structural quality, costs, and staff training. It might also establish training programs and mandate certain minimum requirements to improve quality, for example, reducing child:adult ratios and group sizes and establishing and enforcing safety regulations and certification requirements.

More ambitiously, the public sector might seek to increase the pool of well-qualified individuals who enter and remain in the field of early childhood education through the kinds of tuition subsidies and incentives traditionally used in nursing, physician, and teacher training when shortages appear. It seems especially important to raise salaries for child care providers, given how low they are compared to other occupations. Government might play a role by providing increased information or tax credits to parents, by expanding subsidy programs, or by directly paying providers.

A universal, coordinated high-quality child care system for preschool children of working parents might combine direct provision of services as part of local school district and community-based programs with vouchers that would be accepted by certified providers. Part of the costs could be offset by eliminating current tax credits and subsidies for 3- and 4-year olds.

Incentive and subsidy programs of many kinds exist, but they are not sufficiently widespread. Although federal funds are available to improve the access of lower-income families to child care, in October 1999 only about 1.5 million of the 14.7 million low-income children estimated to be eligible for subsidies were receiving them. States have been slow in making these funds available or have set up programs that have low take-up rates. If states were to expand eligibility criteria to the federal maximum and establish better outreach programs, the demand for high-quality care would clearly increase. Given the opportunity, parents receiving federal subsidies most frequently chose center-based care. (61,62) Nor do subsidies appear to result in a "two-track" system. A study of six community programs by the Urban Institute (60) suggests that subsidy programs enabled parents to access care that was as high in quality as that chosen by better-off, unsubsidized parents.

The Cost of Improving Child Care Quality

What level of investment is necessary to improve the quality of nonparental child care in the United States? This topic has received less attention than the relationship between quality of care and child outcomes. Several existing studies do, however, provide some useful information on the relationship between quality of care and cost, although they are limited in scope and not of recent date.

Two studies using data from a 1989 General Accounting Office survey of 265 accredited early childhood education centers that included measures of structural quality were able to estimate the costs associated with changing the child:adult ratio, the size of the group, and staff characteristics (average education, average experience, and turnover rate) (63,64). In each case they found statistically significant relationships. For example, decreasing the average child adult:ratio by one is associated with increased

costs of roughly 4.5 percent. Thus if the average center in their data, with 50 children and an average annual per-child cost of $6,500, were to reduce the child:staff ratio from 11:1 to 10:1, the annual cost per child would increase by about $306. A one-year increase in the average educational level of the staff is associated with a 3.4 percent increase in total costs, including a 5.8 percent increase in wages. A one-year increase in average staff experience is associated with a reduction in costs of 0.6 percent—including a 2.3 percent increase in the wage bill. Finally, the impact of high turnover rates is clear: the departure of an additional 20 percent of the center's teaching staff increases costs by 6.8 percent.

These data include only accredited centers in the Midwest and South, accepting children aged 4 and 5. Moreover, neither study included a short-term, readily available approach to improving the quality of child care: better training of caregivers, including in-service training. We must, therefore, be cautious in applying these findings elsewhere and should bear in mind that the relationship between improving quality and cost for centers that provide care for other age groups may vary. Future work that incorporates current and nationally representative data will be crucial in evaluating public policy strategies designed to improve the quality of child care. Researchers Richard Brandon of the University of Washington and Sharon Lynn Kagan of Yale University are now conducting research that will make it possible to estimate the costs of improving child care using varied measures of quality; their estimated completion date is Fall 2000.

Conclusions

Child care quality matters, in terms of children's everyday experiences, of their cognitive and linguistic competencies and school readiness, and of their later school achievement and social interactions.

Studies of child care quality in the United States suggest there is room for improvement. Process quality on average is only "fair" or "minimal." For structural quality, the evidence indicates that average group sizes and child:adult ratios exceed recommended standards, and that the educational background of child care workers has declined over the last decade. Both aspects can be improved, through additional public-sector resources and the application of federal standards or higher state standards.

From an economist's perspective, the clear evidence of market failure in the child care sector indicates a need for public-sector intervention. The benefits of high-quality child care accrue not only to the family and the child, but also to other members of society, including all children in schools with children who attended child care; taxpayers who are likely to save in the costs of future schooling, especially through reductions in special education and grade retention; and potentially citizens who gain through reduced crime and public assistance costs. Subsidizing child care for low-income families is consistent with the goals of the 1996 welfare reforms and with an ideology that seeks to encourage and reward work. And in the interest of equality of opportunity, there is a strong argument for extending the benefits of high-quality child care to children in low-income families.

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Child Care Quality: Does It Matter and Does It Need to be Improved?

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Child care has become the norm for young children in the United States. In 1995, 59 percent of children who were 5 years or younger were in nonparental care arrangements on a regular basis (Hofferth, Shauman, Henke, and West, 1998). This care typically began at early ages and lasted substantial hours: with 44 percent of infants under the age of 1 year were in nonparental care for an average of 31 hours a week. In the late preschool years, 84 percent of 4- to 5-year-olds were recorded as being in child care for an average of 28 hours per week. The use of nonparental care in the United States is expected to grow even further as welfare reform is fully implemented (Vandell, 1998).

It is within this framework of widespread and early-age use that questions about child care quality have been raised. Among child care researchers, the established view is that child care quality contributes to children's developmental outcomes, higher quality care being associated with better developmental outcomes and poorer quality care being associated with poorer outcomes for children (Clarke-Stewart and Fein, 1983; Phillips, 1987). This view is reflected in Michael Lamb's (1998) comprehensive critique of child care research that was published in the Handbook of Child Psychology. Lamb concluded, based on extant research, that:

> "Quality day care from infancy clearly has positive effects on children's intellectual, verbal, and cognitive development, especially when children would otherwise experience impoverished and relatively unstimulating home environments. Care of unknown quality may have deleterious effects." (p. 104)

A similar conclusion was drawn in a review prepared for the Rockefeller Foundation (Love, Schochet, and Meckstroth, 1996):

> "The preponderance of evidence supports the conclusion of a substantial positive relationship between child care quality and child well-being. Evidence for this relationship

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> encompasses multiple dimensions of quality and diverse indicators of children's well-being." (p. 3)

This view, however, is not uniformly held. Some researchers and policy makers have begun to question the conventional wisdom regarding child care quality (Besharov, 2000; Blau, 1999c; Scarr, 1998). Sandra Scarr (1998), for example, has concluded that:

> "Widely varying qualities of child care have been shown to have only small effects on children's concurrent development and no demonstrated long term impact, except for disadvantaged children." (p. 95)

A major goal of the current report is to evaluate the research evidence from which these claims and counterclaims are drawn. We then analyze the argument for public intervention to improve the quality of child care, especially for children from lower income-families.

A careful review of the literature indicates that reviewers often draw on the same research studies, but interpret findings differently. These different interpretations are based, in part, on where the reviewers have "set the bar." Some researchers place more weight on studies that include observational assessments of child care quality and that measure psychological processes using multiple strategies (NICHD Early Child Care Research Network, 1994). These same investigators tend to place less emphasis on the necessity of large, nationally representative samples. Although the investigators believe that it is important to assess and control for selection biases, they worry more about overcontrol than undercontrol in their analyses. In contrast, others (see Besharov, 2000; Blau, 1999c, in press) have emphasized the importance of large, nationally representative samples and the need to have sufficient controls in the statistical analyses. These investigators have placed greater credence on information obtained from nationally representative surveys, even if studies lacked observational assessments of child care quality or objective measures of child performance.

An additional factor contributing to different conclusions about child care quality is how heavily reviewers weigh the importance of concurrent vs. long-term findings. As can be seen on Tables 1–3, the research literature describing concurrent associations between child care quality and child performance is

larger and findings are more consistent than the research literature that tests for longer-term effects. A number of factors may contribute to the more mixed picture for long-term effects, including measurement problems and lack of control for experiences during the intervening period. A better consensus about realistic and reasonable expectations about effect sizes also is needed (McCartney & Rosenthal, in press).

Thus, a variety of factors must be considered if we are to determine whether associations between child care quality and children's developmental outcomes are large enough for parents, researchers, and policy makers to care about, and whether effects warrant public or private expenditures to improve quality. In an effort to address these broad issues, we pose five specific questions: (1) How is child care quality measured? (2) Does quality of child care have meaningful effects on children's developmental outcomes? (3) Does child care quality affect maternal employment? (4) What is the quality of care in the United States? And (5) Is there a persuasive economic argument to justify public intervention to improve the quality of child care?

HOW IS CHILD CARE QUALITY MEASURED?

A critical issue in evaluating the research evidence is consideration of how child care quality is measured. Researchers have measured quality in various ways: by observing process, by recording structural and caregiver characteristics, by assessing health and safety provisions. Child care processes refer to actual experiences that occur in child care settings, including children's interactions with caregivers and peers and their participation in different activities. Sometimes process measures are global scores that combine experiences across several areas that include health and safety provisions, interactions with caregivers, and age-appropriate materials. Other process measures target specific activities or experiences, such as language stimulation by caregivers. Structural and caregiver characteristics refer to features such as child:adult ratio, group class size, caregiver formal education, and caregiver specialized training related to children. Structural and caregiver characteristics are conceptualized as more distal

indicators of child care quality. Health and safety provisions refer to both health-promoting practices, such as hand-washing, and safety in the classroom and on playgrounds.

Process Quality

One well-known process measure is the Early Care Environment Rating Scale (ECERS, Harms and Clifford, 1980). This measure is composed of 37 items that evaluate seven aspects of center-based care for children ages two and a half to five years. These areas are personal care routines, furnishings, language reasoning experiences, motor activities, creative activities, social development, and staff needs. Detailed descriptors are provided for each item and each item is rated as inadequate (1), minimal (3), good (5), and excellent (7). The ratings, according to the scale developers, are based on a minimum of a two-hour block of observation in the classroom. The Infant/Toddler Environment Rating Scale (ITERS, Harms, Cryer, and Clifford, 1990) is a related measure that assesses process quality in centers for children younger than two and a half years. The 35 items of the ITERS also are organized under seven domains and are rated on 7-point scales.

These same investigators have developed a 32-item observational measure, the Family Day Care Rating Scale (FDCRS), to assess process quality in child care homes (Harms and Clifford, 1989). Some items parallel items on the ITERS and the ECERS, but other items are unique because the instrument "tries to remain realistic for family day care home settings by not requiring that things be done as they are in day care centers" (p. 1).

As can be seen on Tables 1, 2, and 3, these measures are used widely in child care research. The measures have important strengths, including having good psychometric properties and being relatively easy to use reliably. Their widespread use means that cross-study comparisons are possible. These measures also have some limitations. The global composite score combines features of the physical environment, social experiences, and working conditions for staff. Some of these areas may well have greater influences on children's intellectual functioning or social-emotional well-being than others. The composite score may underestimate effects relative to more targeted scales. A second limitation is that

these measures are setting-specific. As a result, they cannot be used as interchangeable measures of quality, meaning that it is not possible to make simple comparisons across types of care or to combine scores in omnibus analyses that look at quality effects across different types of care. A third limitation is that these measures are not appropriate for assessing in-home care given by nannies or grandparents.

The Observational Record of the Caregiving Environment (ORCE) was developed to address these limitations (NICHD Early Child Care Research Network, 1996, in press-a). Because psychological theory and research have indicated the central role of experiences with caring adults for children's well-being and development, the ORCE focuses on this domain. Both time sampled behavioral counts of caregiver actions (e.g., responds to vocalization, asks questions, speaks negatively) and qualitative ratings of those behaviors over time to characterize caregivers' behavior with individual children are collected during a minimum of four 44-minute observation cycles spread over a two-day period. At the end of each 44-minute cycle, observers use 4-point ratings scaled from 1 = "not at all characteristic" to 4 = "highly characteristic" to describe caregiver behavior. A positive caregiving composite score is created by obtaining a mean score across scales over all of the ORCE cycles at a given age period. Higher scores indicate caregivers who are more sensitive and responsive to a child's needs, who are warm and positive, who are cognitively stimulating, and who are not detached or hostile. Unlike the ECERS, ITERS, or FDCRS, the ORCE can be used in all types of child care and with children across the first five years. Age-appropriate behavioral descriptors for caregivers' behaviors with infants, toddlers, and preschoolers are provided.

Another commonly used process measure is the Caregiver Interaction Scale (Arnett, 1989) that rates teachers' sensitivity during interactions with children. This 26-item measure yields three scores (sensitivity—warm, attentive, engaged; harshness—critical, punitive; detachment—low levels of interaction, interest, or supervision) which are combined to create an overall caregiver quality score. The ratings are made after two 45-minute observations conducted on two separate occasions by two separate observers.

The Assessment Profile (Abbott-Shim & Sibley, 1992a, 1992b) assesses different aspects of quality, namely features related to health and safety, physical facilities, and individualized child services. Different forms of the instrument are available for child care homes and centers. These forms list individual items that are viewed as exemplars of (a) healthy, safe settings, (b) rich physical environments, and (c) settings that meet the needs of adult staff. Individual items are scored using a yes/no format, with "yes" designating items that were either observed or reported by staff. These items can be scored reliably (see NICHD Early Child Care Research Network, 1996). Caregivers have been observed to offer more positive caregiving in settings that receive higher Profile scores (NICHD Early Child Care Research Network, 1996, in press-a).

The CC-HOME Inventory is a measure of process quality that uses a checklist approach to create a quality score across multiple domains, including the health and safety of the physical environment, variety of experiences, and materials (NICHD Early Child Care Research Network, 1996). Derived from Bradley and Caldwell's well-known assessment of the quality of the home environment, 45 items are scored on a yes/no basis and then summed (alpha = .81). In one study, children who attended better-quality child care homes as measured by the CC-HOME Inventory obtained higher Bayley scores at 24 months and higher school readiness and language comprehension scores at 36 months, in comparison to children who attended poorer-quality child care homes (Clarke-Stewart, Vandell, Burchinal, O'Brien, and McCartney, 2000).

Other measures have been less successful in providing reliable and valid assessments of process quality. For example, Lamb and colleagues failed to find concurrent associations between child care quality and child functioning in their study of child care in Sweden (Broberg, Hwang, Lamb, and Bookstein, 1990). One factor that likely contributed to the lack of significant relations was problems with their quality measure. The Belsky-Walker Checklist (Broberg et al., 1990) asks observers to check off if 13 positive events (e.g., caregiver provided verbal elaboration, caregiver gives heightened emotional display; signs of positive regard) and 7 negative events (e.g., child cries; child aimless; caregivers in non-child

conversations) occur at least once during 3-minute observation intervals. This 3-minute time observation frame was substantially longer than the 10- to 30-second intervals recommended for recording social interactions (Yarrow and Zahn-Waxler, 1979). Consequently, the checklist may have failed to detect meaningful distinctions in caregiver behavior because the time interval was too long to detect meaningful differences. This checklist underscores the challenge of designing and assessing process quality. Detecting relations between process quality and child outcomes requires robust measures.

Structural and Caregiver Characteristics

A second approach to describing child care quality is in terms of their structural and caregiver characteristics. Characteristics such as child:adult ratio, group class size, caregiver formal education, and caregiver specialized training are viewed as more distal contributors to quality environments. Structural and caregiver characteristics are the only quality indicators obtained in survey studies such as the National Child Care Survey (Hofferth, Brayfield, Deich, and Holcomb, 1991), the National Household Education Survey (Hofferth et al., 1998), and the National Longitudinal Survey of Youth (Blau, 1999-c). Structural and caregiver characteristics have been collected in addition to process-oriented measures in studies such as the Cost, Quality and Outcome Study, thereby permitting relations between these characteristics and process quality to be evaluated.

Relations between structural and caregiver characteristics and process quality are well-documented in the research literature. Table 1 is a compilation of the studies conducted in the United States that have considered this issue. The table includes information regarding sample size, type of care setting, the structural and caregiver characteristics that were measured, the process quality measures that were collected, and findings that were obtained. As indicated in Table 1, some studies have considered bivariate relations between structural and caregiver characteristics, and process quality using Pearson correlations and t-tests. Other studies (Blau, in press; NICHD Early Child Care Research Network, 1996, in press-a; Phillipsen, Burchinal, Howes, and Cryer, 1997) utilized multiple regression techniques in an effort to isolate the relative impact of different characteristics. As documented on the table, the multivariate results

are consistent with the bivariate and global composite analyses. As is evident in Table 1, studies have considered both global composites of structural and caregiver characteristics and individual factors in relation to process quality (Howes, 1990; Vandell and Powers, 1983).

When child:adult ratios are lower, caregivers spend less time managing children in their classrooms and children appear less apathetic and distressed (Ruopp, Travers, Glantz, and Coelen, 1979). When child:adult ratios are lower, caregivers offer more stimulating, responsive, warm, and supportive care (Clarke-Stewart, Gruber, and Fitzgerald, 1994; Howes, 1983; NICHD Early Child Care Research Network, 1996, in press-a; Phillipsen et al., 1997; Volling and Feagans, 1995). Ratios also are associated with global process quality scores (Burchinal, Roberts, Nabors, and Bryant, 1996; Howes, Phillips, and Whitebook, 1992; McCartney, et al., 1997; Scarr, Eisenberg, and Deater-Deckard, 1994; Whitebook, Howes, and Phillips, 1990). For example, in a study of 414 children who resided in three states, Howes et al. (1992) determined that "good" and "very good" scores on the ITERS and ECERS were more likely in infant classrooms with ratios of 3:1 or less, in toddler classrooms with ratios of 4:1 or less, and in preschool classrooms with ratios of 9:1 or less. More than half of the infant classrooms with ratios higher than 4:1 and preschool classrooms with ratios higher than 5:1 received scores that were categorized as "inadequate."

Group size also has been considered in relation to process quality. In simultaneous multiple regressions that included group size, ratio, caregiver education, and caregiver specialized training, the NICHD Study of Early Child Care (1996; in press-a) determined group size to be uniquely associated with positive caregiving. Similarly, Ruopp et al. (1979) reported group size to predict caregiver behavior even when child:adult ratio was controlled. In these studies, caregivers were more responsive, socially stimulating, and less restrictive when there were fewer children in their classrooms. These relations also are observed in child-care homes (Elicker, Fortner-Wood, and Noppe, 1999; Stith and Davis, 1984).

Caregivers' formal education and specialized training also are related to quality of care. Caregivers who have more formal education (NICHD Early Child Care Research Network, 1996; Phillipsen et al.,

1997) and more specialized training pertaining to children (Arnett, 1989; Berk, 1985; Howes, 1983, 1997) offer care that is more stimulating, warm, and supportive. Highly educated and specially trained caregivers also are more likely to organize materials and activities into more age-appropriate environments for children (NICHD Early Child Care Research Network, 1996). These settings are more likely to receive higher scores on the global quality scales such as the ECERS, ITERS, ORCE, and CC-HOME (Clarke-Stewart, et al., 2000; Howes and Smith, 1995; NICHD Early Child Care Research Network, 1996, in press-a).

Repeated-measure analyses conducted for children in the NICHD Study of Early Child Care at 15, 24, and 36 months ascertained that group size and child:adult ratios were stronger predictors of process quality for infants, whereas caregiver educational background and training were stronger predictors of process quality for preschoolers (NICHD Study of Early Child Care, in press-a). These relations do not appear to be an artifact of restricted ranges. The standard deviations for caregiver formal education and caregiving training were similar at different assessment points. Standard deviations for ratio and group size increased for older children. The differential patterns, then, suggest the merits of an age-related strategy for improving process quality. Ratios and group size may be more critical for infant care; caregiver training and education may be more critical for preschoolers.

Caregiver wages is another factor associated with process quality (Howes, Phillips, and Whitebook, 1992; Scarr et al., 1994). See Table 1. In the Three-State Study, Scarr et al. reported teacher wages to be the single best predictor of process quality. In analyses of the Cost, Quality, and Outcome data set, Phillipsen et al. (1997) determined lead teachers wages to significantly predict scores on the ECERS and the Arnett sensitivity scales.

Although much of the research literature has reported significant relations between structural and caregiver characteristics, and process quality, Blau (in press) has cautioned that these associations may be the result of uncontrolled factors that are confounded with the structural and caregiver characteristics. He argues that these confounding factors might include center policies, curriculum, and directors' leadership

skills. To address this perceived shortcoming, Blau conducted secondary analyses on 274 child care centers that were part of the Cost, Quality, and Outcomes Study. In his first set of analyses, Blau conducted regressions to determine if individual structural and caregiver characteristics were associated with process quality when other factors (teacher, family, center characteristics) were controlled. His findings were consistent with other reports. When child:adult ratios were larger, ITERS and ECERS scores were lower. When caregivers had attended college or training workshops and when caregivers had college degrees in fields related to child care, ECERS scores were higher.

Blau then tested relations between structural-regulable characteristics and process quality using a more stringent fixed-effects model that included center as a control variable. This fixed-effects approach was possible because two classrooms were typically observed in each center. In centers in which there were both infants and preschoolers, one classroom of each type was observed. In centers serving only preschoolers, two preschool classrooms were selected randomly. When center was controlled along with type of classroom (infant vs. preschool), relations between structural and caregiver features and process quality were reduced. Blau interprets this reduction to mean that unobserved center characteristics account for the previously reported relations between structural factors and process quality. Our concern, however, is that the center fixed-effect control is inappropriate. As Blau himself noted, this approach requires within-center variability in the structural characteristics. It is unlikely that classrooms in the same center are highly variable in terms of caregiver training, ratio, or group size, especially given that the model also controlled for type of classroom (infant/toddler vs. preschool). The inclusion of the specific center as a control variable resulted in an underestimation of effects.

Health and Safety Indicators of Quality

Global process quality measures such as the ECERS, CC-HOME, and Profile Assessment include health and safety indicators as a component of process quality. Research conducted in the medical and public health arenas has focused more exclusively on these indicators in relation to children's physical health and safety. More hygienic practices by staff and children (Niffenegger, 1997; St. Sauver, Khurana,

Kao, and Foxman, 1998) are associated with fewer respiratory illnesses and other infectious diseases. These practices include frequent handwashing after diapering, before meals, and after nose wiping. Child injuries in child care settings are most likely to occur on playgrounds and are most due to falls from climbing equipment (Briss, Sacks, Addis, Kresnow, and O'Neil, 1995; Browning, Runyon, and Kotch, 1996). Height of the equipment and lack of an impact-absorbing surface under the equipment have been consistently identified as the factors most highly associated with injuries that required medical treatment. The North Carolina Smart Start initiative was successful in improving the safety of child care centers with playground improvement grants (Kotch and Guthrie, 1998).

Conclusions

The weight of the research evidence demonstrates significant relationships between process quality, structural and caregiver characteristics, and health and safety practices. The next section uses process, structural, and caregiver measures to predict developmental outcomes for children.

DOES QUALITY OF CHILD CARE HAVE MEANINGFUL EFFECTS ON CHILDREN'S DEVELOPMENTAL OUTCOMES?

There are substantial challenges for researchers and policy makers who seek to answer questions about the effects of child care quality on children's development. One well-acknowledged difficulty is the absence of well-controlled experiments in which children are randomly assigned to child care that varies in quality. Instead, investigators have studied children whose families and child care settings are willing to participate. This examination of naturally occurring child care, as opposed to more controlled experiments, poses challenges for researchers and policy makers (Blau, 1999c; Lamb, 1998; NICHD Early Child Care Research Network, 1994; Vandell and Corasaniti, 1990). These challenges are related to family/child selection biases and to restricted variability in quality scores. Before reviewing research findings pertaining to effects of quality, we briefly describe common strategies for addressing these research challenges.

Methodological Challenges

Family/Child Selection Biases. The possibility that families differ in their child care choices is a topic of interest in its own right (NICHD Early Child Care Research Network, 1997; Singer, Fuller, Keiley, and Wolf, 1998). It also is a critical issue for investigators who are interested in ascertaining the effects of child care on children (Howes and Olenick, 1986; Vandell, 1997). The problem is that ostensible "effects" of child care quality may be artifacts of family characteristics that are confounded with child care quality. As a result of this concern, it has become standard practice for researchers to incorporate family selection factors into their analyses. As is evident in Tables 2 and 3, almost all studies conducted in recent years have included controls for family characteristics.

As an example of this strategy, the NICHD Study of Early Child Care has utilized three criteria for identifying family variables that are then used as selection controls in analyses: (1) the family characteristic is significantly related to child care, (2) the family characteristic is related to the child outcome of interest, and (3) the family characteristic is not highly related to other family factors. The third criterion is applied to reduce collinearity among family characteristics.

At one level, concern about family selection bias is clearly merited. There is evidence, for example, that type and quality of child care are related to parents' education and income (see Figure 1). Parents who have higher incomes and more education are more likely to place their children in centers that have higher ECERS scores, lower child:adult ratios, and better-trained teachers (Blau, 1999c; Peisner-Feinberg and Burchinal, 1997). Children with more sensitive mothers are more likely to be placed in care arrangements that offer more positive caregiving experiences (NICHD Early Child Care Research Network, 1997). Children whose home environments are more cognitively stimulating and more emotionally supportive are more likely to be placed in child care settings that are stimulating and supportive (NICHD Early Child Care Research Network, in press-b). These family factors, if not controlled, may masquerade as child care effects.

At another level, however, selection effects do not appear to be as large as initially thought. In the Cost, Quality, and Outcomes Study, for example, the correlation between maternal education and the ECERS was .24; the correlation between family income and the ECERS was .09. In the NICHD Study of Early Child Care, correlations between maternal education and ORCE positive caregiving ratings were .11 at 6 months, .14 at 15 months, .22 at 24 months, and .19 at 36 months. Correlations between family income and ORCE positive caregiving were typically lower than these figures. These relatively modest associations between child care quality and family factors suggest that selection effects are not substantial, at least within the range of studies that have been conducted. In the future, selection effects may be greater as welfare reform is fully implemented and the numbers of children in child care increase.

Variability in Child Care Quality. The ability to detect child care quality effects also is dependent on obtaining sufficient variability in quality scores. Obviously, if there is no variation in quality, it is not possible to detect variations associated with quality. If quality is sampled within a truncated range, effects associated with quality are reduced and larger samples are needed to detect differences. One reason that the Swedish studies have not detected quality effects may be the restricted range of the quality scores that were sampled, coupled with relatively small sample sizes (Broberg, Wessels, Lamb, and Hwang, 1997; Lamb, Hwang, et al., 1988). These same issues are pertinent to child care research in the United States, when restricted ranges of quality are sampled and sample sizes are small.

Control for Prior Child Adjustment. A third challenge is determining when and how to control appropriately for prior child adjustment in examinations of child care effects. Some researchers have argued that stronger tests of child care quality require controls for prior child adjustment. Such controls could be used successfully in studies of after-school programs that controlled for children's adjustment prior to entry into the programs (Vandell and Posner, 1999). Controls for prior child adjustment in studies of early child care quality are more difficult. Children typically begin child care during their first year of life, prior to the time that robust and reliable measures of child cognitive, language, and social adjustment can be administered. Using measures of child adjustment collected at some later period, after substantial

child care experience has accrued, does not make sense because these measures may well be a reflection of the effects of quality to that point. By controlling for child adjustment scores that were already affected by quality, we may be eliminating (or at least minimizing) the very quality effects that are of interest. This potential confounding of child care quality and child adjustment scores means that fixed-effects models that control for prior (or concurrent) child adjustment must be applied with caution.

The Conceptual Model

With these methodological challenges in mind, we turn to the conceptual framework that guides our evaluation of child care quality. This model is presented in Figure 2. A central feature in the model is an awareness that children are not randomly assigned to child care. Child care quality is expected to be related to family characteristics including demographic, psychological, and attitudinal differences. Because these family characteristics—income, parental education, maternal sensitivity, stimulating and supportive home environments—also can predict children's developmental outcomes, it is necessary to control for them. Otherwise, quality effects may be overestimated or underestimated. As shown in the model, research also needs to take into account other child care parameters, such as amount of care and type of care, that may be confounded with quality or that may contribute independently to child outcomes.

Children's developmental outcomes are considered in relation to process quality and in relation to structural and caregiver characteristics. Specifically, the model posits that process quality is directly related to child developmental outcomes. Structural and caregiver characteristics are posited to be indirectly related to child outcomes, through their influence on process quality. It is expected that structural and caregiver characteristics also directly influence child outcomes in ways that are not mediated through the available measures of process quality. In the sections that follow, research findings pertaining to this model are considered in terms of concurrent relations between child care quality and children's development, and in terms of longer-term associations between child care quality and child adjustment.

Concurrent Associations between Process Quality and Child Outcomes

Table 2 is a summary description of results from empirical studies that examined relations between process quality and child developmental outcomes. The description includes sample size, child's age at the time of the concurrent assessments, the measures of process quality that were used, the measures of structural quality that were used, the controls (if any) for family factors, the child developmental domains that were considered, and a summary of findings.

As is evident is Table 2, some of the available research focuses on relations between process quality measures and child behavior in the child-care setting. Other research considers relations between process quality and child behavior outside of child care. The former set of studies provide descriptions of children's immediate reactions to caregiving experiences that are emotionally supportive and cognitively enriching versus experiences that are less supportive and enriching. These studies yield firsthand evidence about children's reactions to care of varying quality. The latter set of studies considers whether reactions to quality experiences are evident in children's behavior in other settings.

Process Quality and Children's Behavior in Child Care. Several investigators have delineated systematic relations between process quality and children's behavior in the child care setting (see Table 2). For example, controlling for child gender and family socioeconomic status, children appear happier in child care settings where activities are developmentally appropriate and caregivers are more involved (Hestenes, Kontos, and Bryan, 1993). Children show more intense negative affect when their caregivers are less involved with them. Children display closer and more secure attachment relationships with their caregivers when the caregivers are more positive and responsive to the children's needs (Elicker et al., 1999; Howes et al., 1992; Howes and Smith, 1995).

Associations between caregiver-child interactions and children's interactions with peers also have been reported (see Table 2). Children who have more positive interactions with their caregivers and more secure relationships with their caregivers appear more prosocial and positively engaged with their classmates (Holloway and Reichart-Erickson, 1988; Howes et al., 1992; Kontos and Wilcox-Herzog,

1997). Children who have opportunities to participate in activities such as art, blocks, and dramatic play demonstrate greater cognitive competence during their free play (Kontos and Wilcox-Herzog, 1997). Taken together, these studies suggest that experiences associated with better quality foster competent performance in the child care setting. By the same token, children are less likely to display competent behavior in child care settings characterized by lower process quality.

Process Quality and Children's Behavior in Other Settings. The next issue is whether process quality is related to children's behavior in other settings. Several studies (see Table 2) have found higher quality child care is associated with better performance on standardized language tests, even when family characteristics are controlled (Burchinal et al., 1996; Dunn, Beach, and Kontos, 1994; Goelman, 1988; McCartney, 1984; NICHD Early Child Care Research Network, in press-b; Peisner-Feinberg and Burchinal, 1997; Schliecker, White, and Jacobs, 1991). These relations are evident when the process measure is a global score such as the ITERS, ECERS, or FDCRS, and when the process measure focuses more narrowly on caregiver language stimulation. It is notable that associations between process quality and language performance are evident for child care that occurs in both centers and homes.

Children's performance on standardized cognitive tests also has been linked to concurrent process quality. Infants who attend centers with higher ITERS scores receive better scores on the Bayley Mental Development Inventory than infants in poorer quality centers (Burchinal et al., 1996). Similarly, children who attend centers that have higher ECERS scores receive higher scores on the CBI intelligence scale (Dunn, 1993). The Cost, Quality, and Outcome Study reported that higher ECERS scores were associated with better scores on the reading subtest of the Woodcock-Johnson (Peisner-Feinberg and Burchinal, 1997).

Finally, process quality is related to children's social and emotional functioning. High-quality care as measured by the ECERS is related to greater child interest and participation, whereas poorer process quality is associated with heightened behavior problems (Hausfather, Tohari, LaRoche, and Engelsmann, 1997; Peisner-Feinberg and Burchinal, 1997). The Bermuda Study (Phillips, McCartney, and Scarr, 1987)

found higher ECERS scores to predict both caregiver and parent reports of children's considerateness and sociability, and caregiver reports of children's higher intelligence and task orientation and less anxiety.

Although the majority of studies (see Table 2) have reported significant relations between process measures of quality and concurrent child functioning, it should be noted that there are exceptions. Scarr and colleagues did not find relations between process quality and children's social outcomes (McCartney et al., 1997). Measurement problems may have contributed to the lack of findings. For example, observers were only moderately reliable on the measures of quality, with exact agreement of 55–58 percent between sites on the ITERS/ECERS. Cross-site reliability in the classroom observations of children's social behavior (a key dependent variable) also was poor to moderate, with kappa coefficients ranging from .40 to .76. The likelihood of detecting associations may have been hampered by unreliable measurements.

Concurrent Associations between Structural and Caregiver Characteristics, and Child Outcomes

There has been a longstanding interest in structural and caregiver characteristics in relation to children's developmental outcomes, in part because the structural and caregiver characteristics are easier to measure and to monitor than process quality. An early study—the National Day Care Study (Ruopp et al., 1979)—included a clinical trial in which 3- and 4-year-olds were randomly assigned to 29 preschool classrooms with different child:adult ratios and levels of staff education. Two levels of ratio (5.4:1 vs. 7.4:1) were contrasted along with three levels of staff education (B.A., Associate of Arts, or less than an A.A. in early childhood education). Child behaviors were assessed at the beginning of the intervention and 9 months later. Children assigned to classrooms with fewer children obtained greater gains on measures of receptive language, general knowledge, cooperative behavior, and verbal initiations, and exhibited less hostility and conflict in their interactions with others than did children assigned to classrooms with larger numbers of children. Children whose assigned teachers had more education and training achieved greater gains in cooperative behavior, task persistence, and school readiness than children whose teachers had less education and training.

Correlational studies also have reported concurrent associations between child:adult ratio and children's language, cognitive, and social functioning. Infants who attend centers with smaller child:adult ratios are found to have better receptive and expressive language skills than children who attend centers with larger child:adult ratios (Burchinal et al., 1996; Vernon-Feagans, Emanuel, and Blood, 1997). Lower child:adult ratios also are associated with higher Bayley scores (Burchinal et al., 1996) and with better social knowledge and social behaviors (Holloway and Reichhart-Erickson, 1988).

Teachers' education and training also are related concurrently to child performance and adjustment. Burchinal et al. (1996) report that infants have better expressive language skills when their caregivers are better educated. Preschoolers' receptive language skills are higher when caregivers have at least an Associate of Arts degree in a child-related field (Howes, 1997). Children whose caregivers have degrees in child-related fields received higher CBI intelligence scores than children with less-educated caregivers (Dunn, 1993). Caregiver education and training in child care homes are similarly related to children's performance on standardized cognitive measures (Clarke-Stewart et al., 2000).

Observations of children's experiences in classrooms and child care homes suggest why these relations might occur. Children are more likely to engage in language activities, complex play with objects, and creative activities in their classrooms when teachers have bachelor degrees in child-related fields (Howes, 1997). Toddlers are more likely to talk with their caregivers and to engage in complex play when classrooms have smaller child:adult ratios (Howes and Rubenstein, 1985). Toddlers are more likely to cry and to have their actions restricted in classrooms in which group sizes are larger (Howes and Rubenstein, 1985). In child care homes, positive caregiving is more likely when group sizes are smaller, caregivers are more educated, and caregivers have more specialized training pertaining to children (Clarke-Stewart et al., 2000).

An alternative research strategy has been to consider aggregated structural and caregiver characteristics. For example, the NICHD Study of Early Child Care (NICHD Early Child Care Research Network, 1999a) assessed four structural and caregiver characteristics (child:staff ratio, group size,

caregiver specialized training in child development or early childhood education, and caregiver formal education) in terms of guidelines recommended by the American Public Health Association. The investigators then summed the number of structural and caregiver characteristics that met recommended guidelines, resulting in summed scores of 0 to 4. At 24 months, 10–12 percent of classrooms met all four standards, whereas 34 percent of the classrooms did so at 36 months. At 24 months, 9 percent of the observed centers met none of the recommended standards; 3 percent of the centers met none of the standards at 36 months.

Associations between the number of child care standards that were met and child outcomes were then tested, with family income and maternal sensitivity controlled (see Table 4). Children who attended centers that met more recommended guidelines had fewer behavior problems at 24 and 36 months, and higher school readiness and language comprehension scores at 36 months. There were significant linear trends between the number of recommended standards that were met and children's concurrent adjustment. Analyses also compared children who were enrolled in classrooms that met a given individual standard with children whose classrooms did not meet that standard (see Table 5). At 24 months, children displayed fewer behavior problems and more positive social behaviors when centers met the recommended child:adult ratio. At 36 months, children whose caregivers had specialized training or who had more formal education exhibited fewer behavior problems and obtained higher school readiness and language comprehension scores.

Longer-Term Associations between Process Quality and Child Developmental Outcomes

Investigators also have considered longer-term associations between process quality and children's developmental outcomes. A compilation of these studies can be found in Table 3. Included in the table are studies that considered relations between earlier child care experiences and later adjustment. To our knowledge, there are no published accounts that relate early child care quality to children's adjustment beyond middle childhood. Table 3 presents information regarding sample size, controls for family factors, descriptions of the quality measures, descriptions of the child outcomes, and specific findings.

Findings on this issue have been reported by the NICHD Study of Early Child Care. Extensive information about the children, the families and child care was collected during home visits (1, 6, 15, 24, and 36 months), child care visits (6, 15, 24, and 36 months), and laboratory assessments (15, 24, and 36 months). Phone interviews were conducted every 3 months to track hours and types of child care. Children who were in nonmaternal care for more than 10 hours a week were observed in that care. The investigators (NICHD Early Child Care Research Network, 1998; 1999b; in press-b) asked if cumulative positive caregiving (the average of ORCE positive caregiving ratings collected during visits at each observation) is related to child developmental outcomes at 24 and 36 months. Mental development at 24 months was assessed in the laboratory with the Bayley. School readiness was measured using the Bracken School Readiness Scale, a scale that assesses knowledge of color, letter identification, number/counting, shapes, and comparisons. Expressive language skills and receptive language skills were measured at 36 months using the Reynell Developmental Language Scales. Mother and caregiver reports of child behavior problems were obtained using composite scores from the Child Behavior Checklist and the Adaptive Social Behavior Inventory. Peer skills were assessed during a videotaped semistructured play situation with a friend.

Relations between cumulative positive caregiving and child development were tested in analyses that controlled for child and family factors (child gender, maternal education, family income, maternal psychological adjustment, home quality assessed by Bradley and Caldwell's HOME scale and videotaped observations of mother-child interaction) and other aspects of child care (time in center and total hours in care from 3 to 36 months). Table 6 summarizes findings from regression analyses and resultant partial rs that indicated effect sizes. As shown, the quality of child care during the first 3 years was related to children's school readiness, expressive language, and receptive language at 3 years. Also shown on Table 6 are comparisons of children in high-quality and low-quality child care (defined with quartile splits), using the same covariates. This extreme group approach yielded d statistics. Effect sizes using this extreme

group approach were significant for measures of school readiness, expressive language, and receptive language at 36 months.

In order to evaluate the magnitude of these findings, the NICHD investigators conducted parallel analyses that tested relations between quality of the home environment during the first 3 years and the child developmental outcomes (using the same covariates), and relations between child care hours during the first 3 years and child developmental outcomes (using the same covariates). Table 6 presents these effect sizes as well. Effects associated with quality of the home environment (the cumulative composite scores created from the Bradley and Caldwell HOME scale and mother-child interaction ratings) were roughly twice the size of the child care quality score. Effects associated with child care hours were substantially smaller than effects associated with child care quality. The NICHD investigators argued that these findings suggest effects of child care quality assessed longitudinally to age 3 years were neither huge nor trivial, but were large enough to be meaningful. It also should be noted that these effect sizes are likely to be a conservative estimate because of the selective participation by higher-quality settings. If the poorest quality child care settings refused to allow observations to be conducted, the range of quality scores would be truncated, resulting in smaller effect sizes.

Longer-term findings obtained from the Otitis Media Study (Burchinal, Roberts, Riggins, Zeisel, Neebe, and Bryant, in press) are consistent with those reported in the NICHD study. In that study, hierarchical linear models were tested. Observations of classroom quality obtained annually over a 3-year period were used to predict children's adjustment up to age 3 years. Higher-quality child care over time was associated with better cognitive development, better receptive and expressive language skills, and better functional communication skills over time, controlling for child gender, family poverty status, and home environment quality.

A limitation with both of these reports is that children were studied only to age 3. Thus, it cannot be ascertained if early effects are harbingers of later differences or if these effects dissipate by the time that children enter grade school. As additional findings from these ongoing investigations become available,

they can be used to identify conditions under which early child care quality differences are maintained or dissipate.

In the meantime, the Cost, Quality, and Outcomes Study has information that is relevant to this issue (Peisner-Feinberg et al., 1999). Started in 1993, observations were conducted in child care centers located in four states—California, Colorado, Connecticut, and North Carolina—that varied in licensing standards. Centers were evenly distributed in each state into nonprofit and for-profit programs. Within the eligible programs, 509 preschool classrooms and 224 infant/toddler classrooms were studied. Process quality was rated using the ECERS or ITERS, the Caregiver Interaction Scale (Arnett, 1989), and the Teacher Involvement Scale (Howes and Stewart, 1987). Quality indicators were combined into a single process quality composite.

A subsample of children was followed through 2 years of child care and the first 3 years of formal schooling (kindergarten through second grade). Children were assessed for receptive language skills, reading ability, and math skills. Child care and school teachers rated the children's cognitive/attention skills, sociability, and problem behaviors each year. Longitudinal hierarchical linear models examined relations between the child care quality composite collected at age 4 (Time 1) and children's developmental outcomes through grade 2. In all analyses, selection factors (maternal education, child's gender and ethnicity) were controlled statistically.

Children who were enrolled in higher-quality child care classrooms as preschoolers were found to have better receptive language skills. Effect sizes for receptive language were moderate for the preschool period (.60 and .51 for the 2 years preceding school entry), more modest in kindergarten (.30), and not significant in second grade. Child care quality also was related to children's math skills. Children who were enrolled in higher-quality child care had better math skills prior to school entry and during kindergarten and second grade, with modest effect sizes across the years (.20–.29). The relation was stronger for children whose mothers had less education. In further analyses that controlled for the quality of the elementary school classroom, the relations between child care quality and children's math skills

were maintained. It is notable that a similar finding was obtained in research conducted in Sweden. Broberg et al. (1997) found that process quality assessed using the Belsky and Walker checklist at 16, 28, and 40 months predicted better math skills at age 8, even after controlling for child and family factors.

Other research has considered longer-term associations between child care quality and children's social-emotional outcomes. Howes (1990) focused on one particular aspect of process quality, child care socialization practices, in relation to children's subsequent developmental outcomes. Caregivers' involvement and investment in child compliance were measured during naturalistic observations in the child care setting. Having a more involved and invested caregiver during the first 3 years was associated with kindergarten teachers' reports that the children had fewer behavior problems and better verbal IQs.

Alternative Views. As shown in Table 3, some investigators have not found relations between child care quality and later developmental outcomes. For example, Chin-Quee and Scarr (1994) did not find evidence of long-term effects in a longitudinal follow-up of the Bermuda study. In the initial study, concurrent associations were reported between process quality as measured by the ECERS and child developmental outcomes (McCartney, 1984; Phillips et al., 1987). In the follow-up study, teachers rated social competence (peer relations and cooperative behavior) and academic achievement for 97 of the original sample of 166, when children were in grades 1 and 2 (Time 2) and grades 3 and 4 (Time 3). Associations between the quality indicators during the preschool years and competence at school were tested with hierarchical regressions in which parental values, age of entry into care, and total amount of child care before school entry were controlled. Neither the global quality score nor the specific measures of caregiver language predicted children's social competence and academic achievement at Time 2 or Time 3.

A longitudinal follow-up of children who participated in the Three-State Study also failed to detect long-term effects (Deater-Deckard, Pinkerton, and Scarr, 1996). In this project, assessments of child care quality were first obtained in 363 classrooms located in 120 centers in three states (Georgia, Virginia, Massachusetts) when 718 study children were infants, toddlers, and preschoolers. Process quality ratings were obtained by pulling items pertaining to teacher-child interaction from the ECERS and ITERS and the

Assessment Profile (a process measure scored for presence or absence of specific items). Four years later, follow-up assessments were conducted for 141 of the original sample. Multiple regressions controlled for child (child adjustment at Time 1, age at Time 2, child gender) and family characteristics (SES, a composite of parenting stress and low emotional support, maternal endorsement of harsh discipline practices). The child care quality measure was a composite of the ITERS/ECERS, the Assessment Profile that measures physical facilities, caregiver training and education, and caregiver wages. In these analyses, the child care quality composite score at Time 1 did not predict changes in children's behavior problems or social withdrawal at Time 2.

Although Scarr (1998) has argued that these studies demonstrate that child care quality has little or no long-term impact on children's development, the findings must be interpreted with caution. Both studies are based on the assumption that a quality assessment obtained at one point in time is an adequate and accurate representation of child care quality. Single assessments might be sufficient if care arrangements and quality are stable; however, a single observation is not adequate if care is unstable or changing. In the Bermuda sample, Chin-Quee and Scarr (1994) reported that half the children experienced one, two, or three arrangements during the intervening period, and half experienced more than three arrangement changes. In the Three-State study, no information about child care quality in the intervening four years was collected. In both studies, it is difficult to interpret the meaning of the null findings in light of no information about child care quality across early childhood. Stronger, more valid tests of the effects of child care quality need to take into account cumulative quality and the pattern of quality over time.

The lack of long-term relations in the Three State Study may also reflect limitations in the assessment of process quality. Only moderate interobserver agreement was reported across the three research sites—.58 for the ECERS and .55 for the ITERS (McCartney et al., 1997). Lower relations between process quality and child outcomes would be expected when process quality scores are less reliable.

Longer-Term Associations between Structural and Caregiver Characteristics and Child Outcomes

Other studies have considered relations between structural and caregiver characteristics in relation to children's subsequent developmental outcomes (see Table 3). Howes (1988), for example, examined structural and caregiver characteristics at 3 years in relation to children's first-grade adjustment. Quality in 81 centers was defined in terms of five areas: teacher training, child:adult ratio, group size, a planned curriculum, and space. Higher-quality care met recognized standards in all five areas; medium-quality care met standards on three or four dimensions, and low-quality care met three or fewer standards. During the intervening period, the 87 children attended the same university lab school, meaning that they experienced classes with the same or similar structural and caregiver characteristics.

In analyses that controlled for maternal work status, family structure, and maternal education, Howes found that children who had attended higher-quality child care programs prior to enrollment in the university school had fewer behavior problems and better work habits as compared to children who had attended lower quality programs. Additionally, boys who had attended higher-quality centers received better first-grade teacher ratings of academic performance compared to other boys.

Using a different sample of 80 children who were enrolled in center-based care, Howes (1990) examined relations between a structural quality composite (child:adult ratio, caregiver training, caregiver stability) measured at 18, 24, 30, and 36 months, and children's kindergarten adjustment. High-quality care was defined as ratios of 4:1 or less for children who were $\leq$ 2 years and 7:1 for children > 2 years, caregivers with 12 units of college-level child development courses, and no more than two different primary caregivers in the prior year. Low-quality care was defined as ratios of 6:1 or higher for children who were 2 years or less and ratios of 10:1 for children who were older than 2 years, caregivers with no formal child development training, and more than two primary caregivers in the prior year.

Associations between structural quality in the first 3 years and children's later preschool and kindergarten adjustment were tested, controlling for a family socialization composite and a family demographic composite. Children with a history of poor-quality child care during the first 3 years were

rated by their preschool teachers as being more difficult and by their kindergarten teachers as being more hostile. The children also engaged in less social pretend play and displayed less positive affect in their preschool classroom.

Recent research from the Otitis Media Study has focused on specific structural and caregiver characteristics in relation to subsequent child developmental outcomes (Burchinal et al., in press). The researchers initially recruited 89 children who were 4 to 9 months of age for a study of the effects of otitis media on children's development. Children attended 27 centers that varied in quality. Child care quality was assessed annually using the ECERS and ITERS. Children whose child care classrooms met recommended guidelines for child-staff ratios exhibited better receptive language and functional communication skills over time as compared to children whose classrooms did not meet recommended ratio guidelines, controlling for child gender, family poverty, and cognitive stimulation and emotional support in the home. Caregiver education also predicted children's adjustment, but only for girls: Girls whose caregivers had at least 14 years of education (with or without early childhood training) had better cognitive and receptive language skills over time compared to girls whose caregivers had fewer than 14 years of education, controlling for the family factors.

Blau (1999c) also has examined structural and caregiver characteristics in relation to children's subsequent developmental outcomes. For these analyses, he used secondary data obtained from the National Longitudinal Survey of Youth (NLSY), an ongoing nationally representative study of 12,652 youth begun in 1979. Beginning in 1986, information about children of the female respondents was collected. Mothers also provided information about their children's primary child care arrangements—the number of children cared for in the group, the number of adult care providers in the arrangement, and whether the main caregiver had specialized training in early childhood education or child development. Blau then averaged these maternal reports of structural and caregiver characteristics through age 2 and for ages 3–5 years. Children completed the Peabody Picture Vocabulary Test (PPVT), a measure of receptive language skills, at 3 years or older. Mothers reported on children's behavior problems at 4 years or older.

Children completed math and reading subscales of the Peabody Individual Achievement Test (PIAT) at 5 years or older.

Simple correlations revealed statistically significant, but small, associations between mothers' reports of caregiver training when the children were in infant/toddler care and the children's later performance. Children whose mothers reported that their caregivers had more specialized training obtained higher math and receptive language scores. When type of care was controlled, these associations continued to be significant. Blau then asked if these structural and caregiver factors uniquely predicted child performance in a regression model that included 64 additional child care and family variables. These controls included number of arrangements that were used, hours per week in care, months per year in care, paid cash for care, cost of care, center care, family day care home, relative care, child gender, cognitive stimulation, emotional support, Hispanic ethnicity, black ethnicity, grandmother worked when mother was 14, mother's education, grandmother's education, fraction of mother's preschool years her mother was present, fraction of mother's high school years her father was present, month of pregnancy in which mother first received prenatal care, child's birth order, Catholic, child received well-care visit in first quarter, mother's age, mother's age at birth of child, siblings in various age groups, and fraction of pregnancy during which mother worked. In ordinary least squares regression analyses, relations between maternal reports of caregiver training and children's math and receptive language scores were no longer evident when these other variables were controlled. From these analyses, Blau concluded:

> "There seems to be little association on average between child care inputs experienced during the first three years of life and subsequent child development, controlling for family background and the home environment." (p. 20)

Blau's conclusion does not appear warranted, for several reasons. First, his analyses relied on maternal reports of structural and caregiver characteristics. Questions can be raised about whether mothers can provide this information accurately, especially retrospectively. Unfortunately, Blau provides no evidence regarding the accuracy of these reports. In order to estimate the accuracy of mothers' concurrent reports of structural and caregiver characteristics, we turned to the NICHD Study of Early Child Care data

set, which included both mothers' and caregivers' reports of group size and child-adult ratio. These reports were compared to observers' independent counts of ratio and group size during 2-day visits. The mean correlation between mothers' and caregivers' reports of group size for children in centers was .55 (range = .51 to .63). The mean correlation between maternal reports of child:adult ratio and observed ratios was .33 (range = .27 to .42). These figures suggest that mother concurrent reports can be viewed as moderately reliable. Maternal retrospective reports of group size and ratio appear to be considerably less reliable. In other studies, near-zero correlations were obtained between observational assessments of group size and child-adult ratio when children were age 4 years (Vandell and Powers, 1983) and maternal retrospective reports of these same structural variables 4 years later (Vandell, Henderson, and Wilson, 1988).

To our knowledge, there are no data available from which the accuracy of maternal reports of caregiver training can be evaluated. We suspect, based on our own personal experiences, that mothers are less likely to know about caregiver training than about group size and ratio, which they can observe. Taken together, we believe that the lack of precision in the mothers' reports in the NLSY result in an underestimation of effects associated with structural and caregiver characteristics.

Blau also adopted a stringent, perhaps unrealistic, test for long-term effects. Child outcomes were assessed a minimum of 2 years after mothers reported structural and caregiver characteristics, and the lag appears to have averaged 5 years or more because children were reported to be, on average, 8 years of age when outcomes were assessed. Interestingly, there was some evidence of longitudinal associations when shorter time lags were considered (even though mothers' reports were used). For example, significant relations were found between maternal reports of child:adult ratios and caregiver training during the first 3 years and behavioral adjustment and math scores for children who were less than 9 years of age. Relations were not evident for very long time period, i.e., children who were older than 9 years. Smaller group sizes during the preschool period (3–5 years) were associated with higher scores on math, reading, and language performance. Lower child:staff ratios were associated with fewer behavior problems. The long lag between the infant quality reports and the child outcome assessments is further complicated by the omission of

quality reports during the older preschool years, resulting in an underestimation of effects associated with child care quality.

Conclusions. Structural and caregiver characteristics have been found to be associated with children's academic, cognitive, behavioral, and social development. Smaller group sizes, lower child-caregiver ratios, and more caregiver training and education appear to have positive effects on these important developmental outcomes. Future work might address threshold levels for these child care characteristics, or the point at which further improvements in structural quality do not yield additional developmental benefits for children.

An Economist's Interpretation of the Link between Child Care Quality and Child Outcomes

The traditional approach of those working in the field of developmental psychology is to use standardized regression coefficients in hierarchical regression models. These seem quite different from the methods employed by economists, but the full model used is a standard OLS regression model, and the standardized coefficients can be converted into the nonnormalized coefficients more traditional in the economics discipline. Doing so allows us to address the question of the expected change in developmental outcomes of children were quality to be improved based upon standard OLS estimates (see Hanushek and Jackson, 1977).

Using estimates based on NICHD data, we perceive that the quality of child care can indeed make a difference. Table 7 reports on the cognitive and language results for the NICHD samples at ages 15 months, 24 months and 36 months (NICHD Early Child Care Research Network, in press-b). Three outcome measures are used: for the younger two ages, the Bayley, CDI vocabulary production, and CDI vocabulary comprehension tests are used; for the oldest age group (36 months) the Bracken school readiness, Reynell expressive language and Reynell verbal comprehension tests are used. (See above for a more detailed discussion of these tests.) In addition to the measures of child care quality, the model includes measures of parental background, quality of the home, the child care setting, and time spent in

child care. These are an attempt to minimize the role of parental selection of child care in order to capture the effects of child care quality differences on measures of child development.

Two models are presented for each age group and outcome measure. The first tests for the effects of the child care quality using a cumulative score of positive caregiving rating, while the second adds a specific measure of language stimulation. Caregivers' behaviors were assessed during four 44-minute observations over two half-days at 6, 15, 24, and 36 months. These were combined into the cumulative positive caregiving rating.

We converted the standardized coefficients reported in NICHD (in press-b), into nonstandardized coefficients. Table 7 only reports those for child care quality that are statistically significant at the 5 percent level. Combining these with the measures of quality and reinterpreting the standardized coefficients indicates the following effects.

The expected improvement in the CDI vocabulary production test for toddlers aged 15 months, when their care quality shifts from one standard deviation below the mean to one standard deviation above, is nearly 7 points, or 24 percent; if the shift is from the minimum score (5) to the maximum (20) in caregiver rating, the estimated gain is 18 points. (Note that the standard deviation is 2.9, within a range of 5–20.) For the vocabulary comprehension score, shifting from one standard deviation below the mean leads to an expected increase of 8 points; and moving a child from the minimum score to the maximum score in caregiver rating is expected to increase a child's score by 21.6 points, or 55 percent of the mean.

At age 24 months, statistically significant changes are registered for the Bayley test and the sentence comprehension test. The Bayley estimates produce an expected increase of about 5 points when the shift is from one standard deviation below the mean to one above. The sentence comprehension results produce an expected increase of 7 points. A shift from the lowest caregiver to the highest increases expected performance on the vocabulary test by about 40 percent relative to the mean, but only about 13 percent in the case of the Bayley test. (Note that for the 24 month olds the standard deviation is 2.9 as well.

and the range is the same as that for those 15 months old, 5–20.) The expected changes are larger for those aged 36 months than for those aged 24 months.

For the Bracken school readiness test at age 36 months, a shift from one standard deviation below the mean on the caregiving rating to one above is expected to lead to an increase of 6.9 points. (Note that the caregiver rating has a larger range for those aged 36 months, 7–28, while the standard deviation is 3.3.) The same shift in caregiver quality is expected to lead to a 5-point increase in the expressive language score and an 8.6 point increase in the verbal comprehension score, relative to the mean. A shift from the lowest rating to the highest for caregiver rating is expected to result in a shift of about 50 percent relative to the mean for each of these three outcomes. These estimates give us some sense of the magnitude of the possible changes in children's outcomes as a result of improvements in positive caregiver rating.

We can do a similar exercise with the second measure of quality, language stimulation. This measure is added to the regression in an alternative specification. In most cases the addition of this measure reduces the estimated impact of positive caregiving. (Because language stimulation is a major component of caregiving quality, this is not surprising.) We simulate the impact of language stimulation only for ages 15 months and 24 months, where it is statistically significant for all three of the child development outcome measures.

For children 15 and 24 months of age, having a child care arrangement in which more language stimulation is provided can play a small but significant role in improving all three of the outcome measures. For children of 15 months, simulating an improvement in caregiver language stimulation from one standard deviation below the mean to one above increases performance on the Bayley test by nearly four points, by 12 points on the CDI vocabulary production test and by about 9 points on the CDI sentence comprehension test. At 24 months of age, a child exposed to a level of language stimulation one standard deviation below the average is expected to gain about 5 points on the Bayley test, or about 4 percent relative to the mean, were the child moved to an arrangement with a rating one standard deviation above the norm, or by 61 units (about one third of the full range of 0–180). The same child would be expected to

gain 12 points on the CDI sentence comprehension test, or nearly 30 percent relative to the mean. And the same child would be expected to gain about 9 points on the CDI vocabulary production test, or about 20 percent relative to the mean.

The NICHD group also estimated models with both concurrent and lagged quality measures (NICHD, in press-b). Their results suggest that the cumulative impact of child care quality may be far greater than the concurrent impact. In Table 8 we provide two examples, one for children at 24 months of age using caregiver quality measures at 15 and 15–24 months, and one at 36 months of age using quality measures from 15–24 months and 36 months. Only those quality measures which are statistically significant at the 5 percent level are reported. Similar measures for language stimulation are chosen as the cognitive outcome measure. Both sets of results suggest that there is a lagged effect of language stimulation and that the cumulative effect of exposure to higher levels of language stimulation appears to be greater than the concurrent impact alone. In the case of those aged 24 months, the converted results suggest that a child who was in a child care arrangement over this entire period that was one standard deviation below the mean (calculated at both 15 and 24 months) is simulated to gain about 30 points on a CDI vocabulary production test if moved to one above the mean. Looking at only the concurrent language stimulation, an increase of 11 points, or about one-third of the full cumulative gain, is simulated. In the case of 36 those aged months, we find that both language stimulation and overall caregiver quality are significantly associated with performance on the Reynell vocabulary comprehension test measured at 36 months, and that only the lagged measure of language stimulation is statistically significant among the two lagged measures of quality. Among these 36-month-olds, we simulate a combined gain of 11 points on the Reynell vocabulary test if the child moved from one standard deviation below the mean on both quality measures to one above the mean over the entire period from 15 months to 36 months. This far exceeds the simulated increase if only the contemporary measures were modified. The respective means of the outcome measures are shown on the table.

The magnitudes of simulated change are large, but the resulting changes are also rather large, suggesting that caregiver quality can significantly influence these outcomes. All of these estimates are subject to the usual caveat that the underlying estimates may not be causal. We should also note that the measures of quality are based on limited observation, so that the effect captured is likely to underestimate the true effect of quality.

Other Outcomes

We now briefly review the findings from a small set of early childhood intervention studies that look at such long-term outcomes as criminal activity, earnings, and the use of cash welfare assistance. The Syracuse Family Development Research Program was a small program that enrolled slightly more than 200 children and followed them for 5 years. It was one of the earlier programs, beginning in 1969. The intervention included infant and preschool enrollment in Syracuse University's preschool program as well as direct provision of information on raising children, nutrition, etc. to the parents. The follow-up analysis found that by age 15, 6 percent of the experimental group had been referred to probation as compared to 22 percent of the controls. Through based on very small numbers, the very large differences provide some evidence that the combined interventions had a positive effect on the reduction of crime (Lally, Mangione and Honig, 1988).

Perhaps the best-known early intervention project is the Carolina Abecedarian Project (Campbell and Ramey, 1995; Ramey, Campbell, and Blair, 1998; Ramey et al., in press). This clinical trial began at 6 weeks postpartum and included (1) a randomized control group (n = 23) that received family support social services, pediatric care, and child nutritional supplements, (2) an experimental group (n = 25) that received the services of a high-quality center-based intervention for the first 5 years and additional educational support services from kindergarten to grade two, (3) an experimental group (n = 24) that received only the early intervention, and (4) an experimental group (n = 24) that received only the K-2 educational support. IQ scores at 8 years and 12 years were significantly higher for preschool participants than for other children. Furthermore, children who had participated in the preschool program had higher scores on tests

of reading and mathematics achievement at 8 and 12 years. They were less likely to be retained a grade at ages 8, 12, and 15, and they were also less likely to be placed in special education. The most recent follow-up report from this research team (Early Learning, Later Success: the Abecedarian Study, 1999) included findings to 21 years. Intervention children were reported to be older, on average, when their first child was born and to have been more likely to attend a four-year college.

The Perry Preschool Project (Schweinhart, Barnes, Weikart, et al., 1993) involving 123 black children has reported long-term follow-up to 27 years. The experimental group consisted of 45 children who entered the preschool program at age 3 and an additional 13 who entered at age 4, attending a half-day center-based program and receiving teacher home visits. The researchers report that the experimental group had a somewhat lower probability of ever being arrested by age 27 (57 versus 69 percent), but a larger difference in the average number of lifetime arrests by age 27 (2.3 versus 4.6). Differences in the proportion receiving public assistance by age 27 were also large: 15 compared to 32 percent. Mean earnings were far higher for the experimental group than the control group at age 27: monthly reported mean earnings were $1,219 for experimentals, $766 for controls.

Participation in the Chicago Child-Parent Centers (CPC) also has been related to long-term beneficial effects (Reynolds et al., 2000). This project has followed the educational and social development of 1,539 African-American (93 percent) and Hispanic (7 percent) children as they grew up in high-poverty neighborhoods in central city Chicago. Some of the children (n = 989) participated in government-funded (Title I) early childhood programs in 1985-1986, whereas others did not (n = 550). A rich array of data, including surveys from teachers, parents, school administrative records, standardized tests, and the children themselves have been collected since that time. Children who participated in the CPC preschool programs obtained significantly higher math and reading achievement test scores at 5, 8, and 14 years, even after controlling for family risk status, child gender, and later program participation. At age 20, participants in the CPC were more likely to have completed high school and to have low rates of juvenile crime.

Even though only a few studies have followed children into adulthood, it is notable that all find some evidence of long-term gains.

Does Child Care Quality Affect Maternal Employment?

In much of the existing literature linking parental employment and child care, the primary issue is the affordability of care and the elasticity of response to child care costs. In this sense one can see the potential for a trade-off between quality of care and labor force participation, in that higher-quality care is likely to be more costly. A parent facing that higher cost may decide to forgo or limit employment or to elect lower-quality and less costly care (Scarr, 1998). Maume (1991) found that a $10 increase in the weekly cost of child care was associated with a 1.6 percent increase in the probability of exiting employment within a year. A slightly earlier study by Blau and Philip (1989) also provided evidence that an increase in the cost of care was associated with an increased probability of a mother leaving the labor force.

Quality of care may influence employment in several ways: parents may be reluctant to leave their child in a low-quality, unsafe environment or with adults who do not provide a stimulating or warm environment for their child. This may be a particular problem for lower-income families, who have more limited choices of providers. In contrast, a safe, warm, stimulating environment may encourage employment and longer hours of work. Parents may also be more effective employees if they do not have concerns about the environment in which their children spend a good part of each working day. Having well-cared-for children may also lead to employees with higher productivity than those whose children are left in less satisfactory environments. Parents may also be more likely to be on time to work and less likely to miss time from work if their children are cared for in a safe, warm and stimulating environment.

Evidence. There is limited evidence on whether higher-quality care has positive impacts on parental employment, because there have been few studies. The available evidence suggests that among low-income women, higher-quality child care may increase employment, stability of employment, and hours of work. See Table 8 for detail on these studies.

Meyers (1993) has explored how a mother's perception of the quality of her child's care and the convenience of the child care arrangement affected her labor market progress in the JOBS program. The results show that a mother's perception of the safety of her child's care arrangement and the trustworthiness of the provider were significant predictors of the mother's continued participation in the JOBS program and in labor force participation more generally. Mothers also responded to the ratio of children to staff: those mothers who reported that the ratio of the children to adults in their care arrangement exceeded professionally recommended standards were more than twice as likely to drop out of the program than mothers who reported that their child's care arrangement met the standard.

Additional evidence that quality plays a role in women's labor force participation comes from another experiment: the Teenage Parent Demonstration. As reported in Ross and Paulsell (1998), among the group of first-time teenage welfare recipients whose members were randomly assigned to the program, which required employment, job training or schooling, nearly a third reported that the quality of child care was a problem that led them to stop working or to change hours and/or activities. Ross and Paulsell interpret this to mean that "Mothers who are required to work as a condition of receiving welfare benefits may try to manage with lower-quality child care than they would in the absence of such a requirement, but this low-quality care may be the reasons that mothers interrupt their employment activities." (p. 40)

Brooks-Gunn et al. (1994) evaluated an early intervention program, the Infant Health and Development Program, in terms of its impact on mothers' employment. This experiment focused on low-birthweight infants and used random assignment to an intervention program that provided center-based child care when the child was 2 to 3 years of age. The authors report that mothers in the intervention group were significantly more likely to be working than women in the control group. Effects were particularly pronounced for mothers with a high school degree or less schooling. Similar beneficial effects of high-quality child care on mothers' subsequent educational achievement were evident in the high-risk sample that participated in the Abecedarian clinical trials (Ramey et al., in press). Benasich, Brooks-Gunn, and

Clewell (1992) report qualitatively similar results for several other early intervention programs (pp. 41–42).

Other evidence (see Hofferth, 1999) that child care quality can influence labor market participation can be found in research studies that differentiate formal arrangements from informal arrangements. These analyses show that parents miss work more often and are late more often if they use informal arrangements. The big difference seems to be the stability of the arrangement—an element of quality.

WHAT IS THE QUALITY OF CARE IN THE UNITED STATES?

The evidence reviewed above indicates that child care quality has meaningful effects on children and their parents. Our next question considers the quality of the care that is available in the United States. One part of this question is a determination of whether high-quality care (of the sort that fosters positive developmental outcomes) is the norm or the exception. The flip side of this question is a determination of the likelihood that children are in poor-quality care that can impair development. Unfortunately, at the current time it is not possible to provide a definitive response to these questions, because observations of process quality have not been conducted for a nationally representative sample of children. In the absence of such a report, we must reply on existing data from multisite studies that provide suggestions about the distribution of quality of care in the United States.

The Cost, Quality, and Outcomes Study (Helburn et al., 1995) provides a perspective on center-based care. ECERS assessments were conducted in 398 centers located in four states that varied in economic health and child care regulations. In that study, 12 percent of the centers received ECERS scores lower than 3, indicating care that was less than minimal quality, and 15 percent received ECERS scores higher than 5, indicating good-quality care. The remainder of the centers were evenly divided between those receiving scores in the 3s (37 percent) and scores in the 4s (37 percent). This distribution of quality scores in the observed settings, however, may be an optimistic view. The observed centers represented only

52 percent of the eligible centers; the remainder declined to participate. It seems likely that the nonobserved settings offered care that was lower in quality.

The Relative and Family Day Care Study (Kontos, Howes, Shinn, and Galinsky, 1995) provides a perspective on quality of care in homes. FDCRS scores were obtained in 226 child care homes and relative care settings in three communities. Minority race, low-income, and nonregulated home settings were over sampled so that the investigators could study the effects of these factors on observed quality. In that study, 34 percent of the child care homes received FDCRS scores of less than 3 and were described as "inadequate," 58 percent were "adequate/custodial," and 8 percent were "good." These unadjusted quality estimates are probably negatively biased, because two of the three states (Texas and North Carolina) have less stringent regulations for child care homes than other states and because nonregulated and low-income settings were over sampled.

Perhaps the best available estimate of process quality for children 3 years or younger is provided by the NICHD Study of Early Child Care. Observations were conducted in nine states (Arkansas, California, Kansas, Massachusetts, North Carolina, Pennsylvania, Virginia, Washington, Wisconsin) and included urban, suburban, and rural communities. The distribution of child care regulations in those states paralleled those in the United States. Observations were conducted in all types of nonmaternal care settings, including grandparents, in-home caregivers, child care homes, and centers. A total of 612 child care settings were assessed at 15 months, 630 child care settings at 24 months, and 674 child care settings at 36 months.

The study sample of 1,364 families was drawn from hospitals at the 10 research sites and included ethnic minorities (24 percent), mothers without a high school education (10 percent), and single-parent households (14 percent) as well as white, middle-class and two-parent households. At 15 months, 17 percent of the households had incomes below established poverty levels (income-to-needs ratio < 1.0). An additional 18 percent of the sample had incomes near poverty (income to needs ratio 1.0 –1.99) (NICHD Early Child Care Research Network, 1997). The sampling plan yielded a large and diverse sample, but it is

not nationally representative. The sampling plan also did not include adolescent mothers (3.8 percent of the potential families in the hospitals), mothers who did not speak English (4.4 percent), and infants of multiple births, with obvious disabilities, or extended hospital stays postpartum (7.7 percent of the births).

Results from the NICHD Study of Early Child Care observations (NICHD Early Child Care Research Network, in press-a) are summarized in Table 9. ORCE ratings less than 2 indicate poor-quality care. Scores of 2 to less than 3 indicate fair-quality care. Scores equal to 3 but less than 3.5 indicate good-quality care, and scores of 3.5 or higher indicate excellent-quality care. Care was most often judged to be only fair in quality. Relatively little care was observed at the extremes, with 6 percent of the settings offering poor quality care and 11 percent of the settings offering excellent care. Poor-quality care was more likely in centers serving infants and toddlers than in centers serving older children (10 percent versus 4 percent).

An extrapolation to the quality of care in the United States was derived by applying NICHD observational parameters, stratified by maternal education, child age, and care type to the distribution of American families documented in the National Household Education Survey (1998).[2] This stratification was needed because the NICHD investigators determined that variations in process quality were associated with these three factors. Based on the numbers of children of particular ages using specific different types of care, positive caregiving was estimated to be of poor quality for 8 percent of children under 3 years in the United States, fair quality for 53 percent, good quality for 30 percent, and excellent quality for 9 percent. These distributions suggested to the investigators that care is "neither outstanding nor terrible, but plenty of room for improvement [remains]."

The quality of child care in the United States also can be estimated based on reports of structural and caregiver characteristics. Drawing on empirical research and advice from professionals in the field, organizations such as the American Academy of Pediatrics and the American Public Health Association

[2]The NHES survey included an early childhood program participation component in its 1995 survey. Parents of 14,000 children from birth through third grade were asked about their use of a wide variety of childcare and early education arrangements. http://nces.ed.gov/nhes/

(1992) have established age-based guidelines for group size and child:adult ratio. For example, the recommendations for child:adult ratios are 3:1 for children from birth to 24 months, 4:1 for children from 25 to 30 months, 5:1 for children from 31 to 35 months, 7:1 for 3-year-olds, and 8:1 for 4-year-olds.

Table 10 lists regulations for child:adult ratio and group size for each of the 50 states as compiled by the Center for Career Development in Early Care and Education (1999). It is clear that very few states have regulations as strict as those recommended by professional organizations. For example, only three states have the recommended 3:1 ratio for infants, and only one state has the recommended 3:1 ratios for 18-month-olds. Two states have ratios consistent with the recommended 5:1 ratio for 3-year-olds. Some states are at substantial odds with the recommended standards. For example, eight states have child:adult ratios of 6:1 for infants. There is a similar failure to meet recommended group size standards, with 20 states having no regulations pertaining to group size.

Another way of estimating the quality of care in the United States is to consider reports of structural and caregiver characteristics. One nationally representative survey, the Profile of Child Care Settings (Kisker, Hofferth, Phillips, and Farquhar, 1991), obtained this information in 1990 from child care centers, early education programs, and licensed child care homes. According to the Profile, the average child:adult ratio was 4:1 for infants under 1 year of age, 6:1 for 1-year-olds, and 10:1 for preschoolers. This report indicates that the average center and child care home in 1990 did not meet standards for child:adult ratios that have been linked to higher quality. In contrast, the Profile of Child Care Settings found that caregivers tended to be well educated and to have specialized training pertaining to children. Nearly half of all teachers reported that they had completed college (47 percent) and an additional 13 percent reported a two-year degree. Most of the remaining teachers had a Child Development Associate (CDA) credential (12 percent) or some college experience (15 percent). Only 14 percent did not have any education beyond high school. Ninety percent of the teachers in child care centers reported that they had received at least 10 hours of in-service training.

The Profile survey found that regulated child care home providers had less formal education and training than teachers in centers. Approximately 11 percent of regulated home providers reported that they had completed college; 34 percent had no schooling beyond high school. About two-thirds had received specialized in-service training. This study represents the best available information regarding structural and caregiver characteristics from nationally representative samples. The survey is dated, however, in that the data were collected in 1990, so the reports may not reflect current structural and caregiver characteristics.

Published reports from two additional national surveys are less useful for this issue. The National Child Care Survey,1990, and the National Household Education Survey, 1995, collected information from parents regarding child:adult ratios and caregiver training. The published reports from these surveys (Hofferth et al., 1991; Hofferth et al., 1998), however, did not present ratio and group size information separately by children's age. As a result, it is not possible to use the reports to evaluate the percentage of child care settings that meet (or fail to meet) standards for infants, toddlers, and preschoolers that are set differently. A second limitation of these reports is that parents may not be accurate respondents of these quality parameters.

A third source of evidence pertaining to structural and caregiver characteristics is the NICHD Study of Early Child Care (NICHD Early Child Care Research Network, 1999a). In that study, child:adult ratios were observed at regular intervals and caregivers reported their educational background and specialized training. The percentage of center classrooms that met the AAP and APHA recommendations for child:adult ratio and group size is shown on Table 12. Also shown are the percentage of classrooms in which caregivers had at least some college and specialized training. As indicated, 36 percent of the infant classrooms were observed to have the recommended child:adult ratios of 3:1. Fifty-six percent of caregivers in infant classrooms had received specialized training during the preceding year; 65 percent of infant caregivers had some college courses. Proportions were similar for toddler care (the 15- and 24-month-olds). When compared to figures reported in the Profile of Child Care Settings, the NICHD figures

suggest that there has been some decline in the educational background and training of child care staff during the 1990s.

The decrease in caregiver education and training may be related to the generally low wages in the child care field (see Figure 3). In 1997, child care teachers averaged $7.50–$10.85 per hour, or $13,125–$18,988 per year, when they were employed for a 35-hour week and a 50-week year. Wages for assistant teachers were $6.00 to $7.00 an hour (or $10,500–$12,250 per year). Figure 1 shows salaries for lower-paid and higher-paid child care workers relative to the median salaries of women 25+ by level of education for both 1992 and 1997. The figure shows the low salaries of child care workers relative to other occupations and indicates that there has not been any improvement in terms of the relative salaries over the 1992–1997 time period for most levels of education. While high school graduates who were child care teachers or assistants could only earn between 73 and 85 percent of the salaries they might expect to receive elsewhere, the relative salaries were far lower relative to the median for women with more schooling. A child care teacher with a B.A. degree could expect to earn between 52 and 75 percent of the median salaries across all occupations. Current child care salaries are not consistent with attracting and keeping providers who have the level of education and training that research suggests is needed to structure emotionally supportive and cognitively stimulating learning environments.

The generally low salaries earned by child care staff also appear to be a factor contributing to high staff turnover in the child care field (see Figure 4). In 1997, 27 percent of teachers and 39 percent of assistants left their jobs during the previous year (Figure 5 and Whitebook, Howes, and Phillips, 1998). Twenty percent of centers reported losing half or more of their staff. Centers that offer higher wages have lower turnover rates than centers that offer lower wages (Whitebook et al., 1998).

IS THERE A PERSUASIVE ECONOMIC ARGUMENT TO JUSTIFY PUBLIC INTERVENTION TO IMPROVE THE QUALITY OF CHILD CARE?

Market failure is defined as a "a situation in which a market left on its own fails to allocate resources efficiently" (Mankiw, 1998, p. 10). Wherever market failure exists, public sector intervention may improve the performance of that sector of the economy. In the child care sector, market failure stems from two sources: lack of information and the existence of externalities (effects beyond the primary consumers). Regarding the first, a major problem is the absence of information on the part of parents, including information on the quality of child care, sometimes on the availability of care, and often on the net costs of alternative arrangements. Related to this lack of information is the difficulty in capturing process quality by measuring observable differences in structural quality. Even information on the structural quality differences is not easily obtained a priori, and the cost of acquiring information can be high.

One difficulty in providing information to parents is that much of this market is made up of small providers. Parents may know something about the child care used by their neighbors, but very little about other types or providers of care. Parents report being unsure about how to go about evaluating child care quality. Child care convenience also is of considerable concern to parents limiting their search to care in particular small geographical areas. This way of thinking about market failure is quite similar to that of medical providers. The problem may be particularly acute for lower-income families and for families who need care for evening or weekend employment (Vandell, 1998).

The second major cause of market failure is the existence of externalities. The benefits of quality care accrue not just to the parent(s) but also to the child and to society more generally. Parents may take all or part of the benefit to their child into account, but not benefits that are external to the family. Such benefits include lower costs for subsequent schooling (reduced probability of grade retention and special education, for example), future reductions in crime, increased productivity that results in higher productivity for others, payment of higher taxes, and possibly lower costs for social services. Improving

child care quality may affect grade school classrooms by increasing the proportion of children in the class who have strong language and cognitive skills. By the same token, poor-quality child care may undermine grade school classrooms by increasing the numbers of children with academic and social deficits. Unsafe and unhealthy child care may result in reduced productivity for others, when parents are absent from their jobs, caring for injured or ill children. Adding these benefits to the parent's demand for higher-quality care should shift the demand curve for quality care to the right (that is, increase demand for higher-quality care at every price).

There may also be a third cause of market failure, an imperfect capital market. Parents of young children tend to have low incomes relative to their permanent income, but may face borrowing constraints that reduce their ability to pay for high-quality care.

Justification for government intervention may also be based on distributional or equality-of-opportunity goals. This may be especially relevant today, in view of the requirement that most low-income single parents work. The core argument here is that if high-quality child care can provide gains in cognitive ability, school readiness, and social behavior, children in low-income families should be given an opportunity to benefit from such experiences just as high-income children benefit. Parents with limited earnings do not have the private means to purchase high-quality child care for their children. Government subsidies are necessary if equal opportunity for high-quality care is to be afforded children in low-income families. The other side of this argument is that if subsidies are not provided, parents with limited incomes will use poor-quality care, including multiple arrangements, which may be detrimental to the safety of their children, may increase family stress, and may result in children with reduced opportunities. A subsidy (or direct provision of care) for children in low-income families could also complement the Earned Income Tax Credit and serve as an employment-related income subsidy (see Council of Economic Advisers, 1997).

There are additional issues regarding availability of child care for families with very low incomes and/or unusual and nonflexible hours of work. According to several studies:

> "The structure of low-wage work and its lack of fit with the structure of more formal child care options restricts the access of low-income families to child care centers and many family day care

> homes. Data from the National Child Care Survey indicate that one-third of working-poor mothers (incomes below poverty) and more than one-fourth of working-class mothers (incomes above poverty but below $25,000) worked weekends" (Hofferth, 1995).

Yet only 10 percent of centers and 6 percent of family day care homes reported providing weekend care. Almost half of working-poor parents worked on a rotating or changing schedule, further restricting these families' child care options to more flexible arrangements made with relatives, friends, and neighbors.

The features of low-wage work appear to promote reliance on multiple providers as a way of patching together child care to cover parents' nonstandard and shifting work hours (Siegel and Loman, 1991). Meyers added that irregular and unpredictable work schedules led to disruptions in child care for the families in her study of the California GAIN program (Meyers, 1993). Deborah Phillips wrote (1995)

> "In sum, when selecting child care, many working-poor and low-income families must choose from a seriously constrained set of options. They face a set of obstacles that derive primarily from the structure of low-wage jobs and from the meager incomes that these jobs provide. Their low incomes enable them to afford only free care by relatives and friends or very inexpensive care; their nonstandard and often rotating work hours restrict them to arrangements with flexible and weekend or evening hours of operation. These factors may also lead to greater reliance on multiple providers and expose young children to shifting child care arrangements."

This lack of stability and frequent changing is itself a measure of poor quality of care.[3]

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[3]According to several studies, low-income families use more of certain types of child care and less of others than do families with more income or more education (see Figure 6). According to the study by the National Academy (Phillips, 1995) low-income families "are more likely to rely on relatives and less likely to rely on center-based arrangements. . . Grandparents are an especially prominent source of child care for low-income, preschool-age children: 17 percent are cared for mainly by grandparents; 29 percent get some care from a grandparent. The child care arrangements of low-income families also vary greatly by household type and parental employment status. . . Single employed mothers rely to a much greater extent on non-relative arrangements (notably family day care homes and centers) than do other types of low-income families. In addition, among low-income families, about 24 percent of children under age 5 are in more than one supplemental arrangement on a regular basis (Brayfield et al., 1993). Reliance on multiple arrangements varies, however, from 14 percent of low-income preschoolers with two parents to 31 percent of those in single-mother families and 45 percent of those in employed, single-mother families"(Phillips, 1995, Chapter 2).

Connelly and Kimmel (2000) use a merged sample from the 1992 and 1993 SIPP panels which include child care questions from June through December 1994. They examine the choice of child care of full-time vs. part-time employed mothers, married and single. Table 13 shows their prediction, by marital status, of the marginal effects of the included variables on the probability of choosing among the 3 modes of child care for single employed mothers. The first panel uses a single predicted price for child care and the second includes three predicted prices of care. For single mothers, the predicted conditional probability of full-time employment is a significant predictor of child care. As has been suggested by earlier research, single mothers who are working full-time are more likely to use center-based care. This also leads to the conclusion that as more mothers enter full-time employment after leaving welfare, the utilization of center-based care over other types of care will increase. The reported results also show that women with more education are more likely to use center-based care or home-based care and that women on AFDC who receive more dollars are somewhat more likely to use center-based care and less likely to use relative

The market failure components argue for government intervention in improving child care. They all lead the authors of this report to believe that the demand for high-quality care is too low. And because demand is too low, compensation is too low, resulting in better-trained providers tending to seek employment in other spheres. This results in a decline in quality unless intervention occurs. Intervention can take many forms.

The arguments behind the need for a role for government (including subsidies for child care) is quite similar to those for primary schooling. Traditionally, the amount of schooling provided has heavily depended on the public sector. For children up to the age of 16, or older in some states, schooling is mandatory, and is provided by the public sector. In the cases of elementary and secondary education, public colleges and universities, the price charged tends to be far below the marginal cost of schooling. Evaluation of the appropriate level of public investment in education requires an analysis of all returns to schooling, including nonmarket and external effects. For example, greater education may lead to social cohesion and may enable one to use new technologies; it may reduce the probability of criminal acts, reduce the probability of application and receipt of transfers, and it may increase savings rates. (For more on this see Wolfe and Zuvekas, 1997 and Michael, 1982.)

Many of the benefits of child care are like those of primary schooling, because child care is early childhood education. These early childhood educational experiences affect children's readiness for primary schooling in the same way that primary schooling affects children's readiness for secondary schooling. In both cases many benefits are external to the child and family. The community at large would benefit from the cognitive, language, and behavioral competencies that are associated with higher-quality child care. The argument for equality of opportunity is similar as well.

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care. Somewhat surprisingly, single mothers with higher predicted wages appear more likely to use relative care or home-based care than center care. The authors explain this by hypothesizing that higher-wage jobs are more likely to be positions that require more flexibility than center care can provide in terms of pick-up and drop-off times and the care of sick children.

A high-quality child care system also is needed if welfare reform is to succeed. The recent change in welfare policy, establishing work requirements, means that more parents, particularly single parents, are working, because work is their only potential source of income. Requiring work means that more parents must find child care for their children. Given this increase in demand, the issue of child care quality becomes even more important. Unfortunately, as described in earlier sections, much of the child care in the United States is not of high quality. Over 60 percent of children under the age of 3 are receiving care in which positive caregiving is not characteristic. Only 10 percent are in care settings that are described as excellent.

WHAT MIGHT BE DONE TO IMPROVE THE QUALITY OF CHILD CARE?

A wide variety of approaches might be used to improve child care. Figure 7 provides a path model that attempts to identify the various links between interventions and quality, taking into account parents' resources. Most of the interventions would be included in the elements of the left column. These include the provision of information, licensing requirements, placement activities, subsidies to compensate child care workers, training programs for providers, tuition subsidies for students who enroll in early childhood education, increased tax credits to cover the cost of care for lower- to middle-income families, incentive payments to individual teachers and assistants who remain in the same center for a minimum of 3–4 years, and even direct provision of care. In the longer run, we need research to help better identify those factors that best improve the quality of child care. In essence, we need better understanding of the production of high-quality care, which may differ for children of different backgrounds.

The minimum roles for the public sector are as providers of information on available slots, hours of operation, structural quality features, costs of care and education, and training of personnel. The government might also establish a certification program to certify providers who met certain requirements. Minimum standards need to be strengthened in many states. Incentives might be offered to providers who meet certain requirements. Other government activities to increase the availability of high-quality care

include operation of training programs and covering the cost of instructors and facilities for these programs. Information on the successful completion of such programs could be disseminated by the public sector as part of its information activities.

A more ambitious role designed to increase the pool of well-qualified individuals who enter (and remain) in the field of early childhood education would be some form of tuition subsidy for those willing to major in this field. There is a long tradition of such programs when shortages are feared; examples include nursing education and medical school. An alternative might be a college loan forgiveness program based on years spent as a child care provider following college, or Associate degree completion. Another approach to increasing the pool of qualified providers is to raise salaries. This seems especially important given the relatively low salaries in child care compared to other occupations (see Figure 1 and the discussion of the figure above). Such increases might result from increased information to parents, tax credits to parents, and the expansion of subsidy programs or direct payment to providers by the public sector. An innovative program might reward the stability of providers by paying a bonus after some specified period of years.

Current programs to improve child care quality exist and might be replicated or expanded. For example, a broad-based community initiative in North Carolina (Smart Start) has been successful in improving child care quality (Bryant, Maxwell, and Burchinal, 1999). This initiative, established by the governor of North Carolina in 1993, is a partnership between state government, local communities, service providers, and families. Twelve county partnerships were initially selected based on competitive review to receive funds for new and improved child care services. Data to evaluate the effectiveness of the initiative were obtained in 1994 and 1996 from over 180 child care centers in 12 counties. Local quality improvement activities (in 1996) were distributed as follows: training workshops (83 percent), funds to attend training activities (53 percent), on-site consultation or technical assistance (58 percent), higher child care subsidy rates (35 percent), increased subsidies for meeting higher standards (29 percent), funds to improve quality by purchasing new equipment (70 percent), funds to improve quality by purchasing

new educational materials (63 percent), funds to achieve higher licensing level (26 percent), funds to achieve national accreditation (13 percent), funds to improve services for children with disabilities (11 percent), teacher substitute pool (20 percent), transportation services (18 percent), lending library (51 percent), and provider compensation programs (35 percent). The mean number of improvement activities per center was 5.3 in 1994 and 5.8 in 1996, with a range of 0 to 14 activities each year. In both years, ECERS scores were significantly related to the number of local quality improvement activities in which individual centers participated. In addition, process quality was significantly higher in 1996 than in 1994. Only 14 percent of centers were rated as good quality in 1994. In 1996, this figure was 25 percent. Participation in the Smart Start initiative also was related to a significant increase in the percentage of centers that obtained the higher-level Associate of Arts licensure credential.

Other efforts to improve quality might be to mandate certain minimum requirements. These can take the form of reducing child:adult ratios, reducing group sizes, establishing and enforcing safety regulations, and education and training. An example of such regulations is a model standard that applies to small family home caregivers. The National Health and Safety Performance Standard (American Public Health Association and American Academy of Pediatrics, 1992) states that one small family caregiver who does not have an assistant "shall not care for more than six children, including no more than two children under age 2. These numbers include the caregiver's own children under the age of six. If any child under age 3 is in care, there shall be no more than four children, including the caregiver's own children under the age of six. If only children under age 2 are in care, there shall be no more than three children, including those of the caregiver" (Chapter 1, Staffing).

We also have training programs for providers of child care. The Department of Labor, Bureau of Apprenticeship and Training, West Virginia Child Care Development Specialist Registered Apprenticeship Program offers child care apprentices 4,000 hours of supervised on-the-job training and 300 hours of classroom instruction. The child care providers earn their salaries while they are in the program and receive incremental wage increases as their skill, ability, and knowledge increase. The DOL reports that employers

report almost no turnover among child care providers and that providers remain highly satisfied with their careers (http://www.dol.gov/dol/wb/public/childcare/child3.pdf).

Private employers may sometimes directly or indirectly provide resource and referral services. Some employers contract with private agencies to assist employees in learning about the range of child care options. The government could encourage such activities by providing subsidies or tax credits to firms if they provide such assistance. An example of this is the program at the Virginia Mason Medical Center which offers child/family resource and referral services.

Recent reports suggest that although some federal funds are available to improve access to higher-quality care among lower-income families, some states have not made these funds available or have set up programs that result in low take-up rates. According to "Access to Child Care for Low-Income Working Families" released in October 1999, 1.5 million children of 14.7 million (about 10 percent) in low-income households were receiving child care subsidies. The major source of funds is the Child Care and Development Fund (CCDF), a federal program that provides funds to states to subsidize child care. According to federal law, children living in families with incomes up to 85 percent of median income in the state could be eligible, but states have set lower limits (http://www.acf/dhhs.gov/news/ccreport.htm). The levels set and the take-up rates differ across states. The report details coverage in each state and take-up rates. Expanding eligibility to the federal maximum level and/or encouraging take-up of the existing subsidies through outreach are ways to increase the demand for high-quality care.

Data aggregated from state agencies indicate that the child care arrangement most frequently chosen by parents receiving direct federal subsidies is center-based care (Phillips, 1995), see Figure 8. This evidence indicates that families do respond to available subsidies. The profile of arrangements used by these low-income parents is strikingly different from that used by all low-income families. Siegel and Loman (1991) found, as well, that AFDC families in Illinois showed different distributions of child care use based on whether they received a child care subsidy and which subsidy they received. Families receiving a child care benefit that reimbursed them for their child care costs 30 to 60 days after they had

incurred these costs were discouraged from using child care options they could not afford with their disposable income. Their patterns of use were similar to those of unsubsidized, low-income families. In contrast, families who received subsidies through programs that either subsidized providers directly or enabled the families to pay providers when fees were due showed substantially higher rates of reliance on center-based and formal family day care arrangements.

Subsidies can help low-income families gain access to the same range of quality options that are available to higher-income families. The Urban Institute's survey of resource and referral agencies in six communities provides evidence that the quality of care received by subsidized children was as high as that for higher income, fee-paying children, as perceived by resource and referral staff (Phillips, 1995).

Another approach that could be combined with subsidies for very young children would be to provide universal coverage for child care (or coverage for children whose parents worked more than 20 hours per week) for pre-school-age children. Such a program could expand existing prekindergarten programs to a full day and include after-school care. These programs could be established for 3- and 4-year-olds through a combination of direct provision through a local school district, existing community-based programs, and vouchers that would be accepted by certified providers. Part of the costs of this care would be offset by eliminating tax credits and current government subsidies for 3- and 4-year-olds. States and local communities would decide on the details of the provision of care, and financing would be shared across levels of government. Part of a coordinated, high-quality child care system for toddlers also might include community- and school-based centers and family day care networks. Because of the necessary low child:adult ratios (and their attendant expense), part of a coordinated child care policy for infants might include vouchers that would allow a parent to stay home and care for the infant during the first year.

Assessment of the Cost of Improving Quality

As we suggested, analyses that shed light on the developmental benefits of child care characteristics for children is an important element of the answer to our question. A related task involves determining the levels of investment necessary to achieve improved quality. Although this topic has not

received the same level of attention in the literature as the overall relationship between quality of care and child outcomes, several studies consider the financial costs of increasing structural measures of quality. Though subject to limitations that affect the extent to which one may apply these findings to the current system of child care, this research provides useful information on the relationship between the quality of child care and cost.

The U.S. General Accounting Office (GAO, 1990) report and Powell and Cosgrove's (1992) summary of and addendum to this GAO research include estimated cost functions for the provision of child care as well as a model of the factors that affect wages of care providers. The modeled cost function allows the authors to examine the direct influences of input prices; center characteristics, including structural measures of quality; and geographical location on center total variable cost. This use of multiple regression analysis allows the authors to estimate the effect of changing such factors as the child-adult ratio on center total costs, after controlling for other relevant factors such as group size, location, and average education of providers. By also modeling the elements of wage determination, the authors capture the indirect effect of changes in child care characteristics on the wages of providers. The results from both models are then combined to examine direct and indirect effects of quality changes on total variable costs.

Data on child care centers from a 1989 GAO survey of 265 early childhood education centers accredited by the National Associate for the Education of Young Children (NAEYC) were used in both studies.[4] The survey, administered to program directors via questionnaire, included questions of center characteristics, costs, value of in-kind donations received, staff characteristics and compensation. The survey includes several structural measures that allow the authors to estimate the costs associated with changing the following quality measures: the average number of children per teaching staff member;

[4]The NAEYC accreditation criteria include guidelines for staff-child interaction, curriculum content, staff qualifications and training, group size and adult-child ratios, physical environment and safety, nutrition.

average number of children in groups of four-year-olds; average education of staff in years; average experience of staff in years; and the staff turnover rate.[5]

The authors find statistically significant relationships between center total cost and structural measures of child care quality. For the adult-child ratio, they find that an improvement in the quality of care achieved by decreasing the average ratio by one, for example from 11:1 to 10:1, is associated with increased costs of roughly 4.5 percent. The authors note that the average center in their data, one with 50 children and an annual per child cost of $6,500, which reduces the child-to-staff ratio from 11:1 to 10:1, faces an increase in annual cost per child of $306.[6] A related measure, average group size, had a small but statistically insignificant effect on total costs.

Changes in cost resulting from improving staff education and experience are estimated using the estimated cost and wage functions to capture total direct and indirect effects. The authors find that a one-year increase in average education of the teaching staff is statistically significantly associated with a 3.4 percent increase in total costs, which includes a 5.8 percent increase in wages. Similarly, increasing average teacher experience by one year is significantly associated with a reduction in center total costs of 0.6 percent, including an estimated increase in wages of 2.3 percent. This implies that increasing staff experience is associated with an increase in quality as well as a slight reduction in average center total costs. There is also evidence of a relationship between turnover rates and total costs—the departure of an additional 10 percent of the center's teaching staff increases costs by 6.8 percent.

These studies have several limitations. First, they rely on data that are more than ten years old. If the relationships estimated in their model have changed since 1989, these estimates will differ from what we would expect to find using current data. Changes in quality made now may affect total costs in a different manner.

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[5]The other variables included in the model are average hourly wages for teachers and aids; rent; cost of other supplies and services per child; indicators for whether a center is for-profit, serves infants, serves children with disabilities, has operated for less than two years; and geographic location.

[6]These estimates are expressed in current dollars. The original estimates in 1988 dollars are $4,500 and $207, respectively.

Also, the data include only accredited centers. If these centers have cost functions that systematically differ from unaccredited centers, the estimated results will not apply to those centers. If, for example, one is most concerned with improving poor quality child care, and such care is more likely to be found in unaccredited centers, these estimates may not provide an accurate depiction of the costs of doing so. The sample also only includes data for care of 4- and 5-year-old children. Because of differences in providing care for other age groups, the relationship between improving quality and costs for centers that provide care for other age groups may vary.[7] Finally although the sample includes data from many states, 70 percent of the centers surveyed were in the South and the Midwest. The results therefore may not be nationally representative.

Helburn (1995) estimates a similar cost function using data collected as a part of the Cost, Quality, and Child Outcomes in Care Centers (CQO) study. The CQO study, conducted in 1993–1994, included data from 401 child care centers (749 classrooms) in four states. The data, collected through classroom observation and interviews with program directors, include information on center characteristics, program quality and staff qualifications, compensation, and turnover. Helburn estimates center total costs as a function of staff wages at different education levels, hours of child care provided, physical size of the center, volunteer hours, region of the country, for-profit status, and quality measures.[8]

This research also indicates statistically significant relationships between cost and quality. Increasing center quality by 25 percent (from mediocre to good) is associated with increases in total variable costs of approximately 10 percent, or $346 per child per year. The authors define quality using an index similar to the ECERS measure of quality of care. Using the ECERS 7-point scale, the mean value of this index in their sample is 4.0, which ranks between fair and good. They estimate that the increase in

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[7]The authors do control for centers that provide infant care, but cost structures would nevertheless be expected to differ, for example, in infant-care centers that do not provide care to 4- and 5-year-olds.

[8]The relationship between structural measures of quality and total variable costs are also tested, but there is no evidence of statistically significant relationships. The authors note that their index measure of quality may be a theoretically superior measure insofar as the structural characteristics capture only a portion of the "true" measure of quality. They argue that this is the case if the unobserved center quality characteristics are correlated with other independent variables.

total variable costs associated with increasing the measure of quality by 25 percent to 5.0, a rating of good quality, will be approximately 10 percent. Given an average size of 60 children per center, the increase in quality is expected to result in an increase in costs of approximately $20,700 per year.[9]

Helburn notes that this analysis assumes that wages are held constant during the quality-changing process. The model specifically implies that wages for particular quality-levels of staff (here measured by years of education) are set in the labor market and centers pay the going wage. If, however, high-quality centers pay higher than market wages to attract the most qualified providers, or to increase productivity and/or lessen the chance of turnover among existing workers, then estimated costs will understate true costs.

Although this study considers all types of centers, not accredited centers only, it has similar limitations to the GAO and Powell and Cosgrove studies. That is, the data used are not as recent as would be desired, and the results from the four-state sample are not nationally representative.

Although all three studies have limitations, the estimates do provide information on the nature of the relationship between child care costs and quality. As such this research serves as a useful starting point for further consideration of this topic. The importance of developing cost estimates suggests that future work incorporating current and nationally representative data will serve as an important source of information for evaluating public policy strategies designed to improve the quality of child care. We have discovered one likely source of such estimates in research currently being conducted by Richard Brandon at the University of Washington and Lynn Kagan at Yale University. The authors are developing a detailed simulation model to estimate costs of improving child care using varied measures of quality. This research, which the authors estimate will be completed by the fall of 2000, will provide valuable additional information

None of these studies include the investment that is likely to be the least expensive approach to improving quality: caregiver training, including in-service training. There are a variety of training

[9]These estimates are expressed in current dollars. The original estimates in 1994 dollars are $300 and

programs that have been offered to formal and informal caregivers. The evidence above suggests that better-trained caregivers give higher-quality care. We do not know enough about the content or length of these programs to be able to definitively discuss their cost. Curriculum and materials are readily available (see for example the materials available from Teaching Strategies, Inc.) One program suggests that a 12-workshop series would enhance caregiver's skills in areas that range from safety through cognitive development and communication skills.

CONCLUSIONS

We conclude this report by returning to primary questions raised in the report: Does child care quality matter? Does child care quality need to be improved, and can it be improved? Is there an economic justification for public intervention to improve the quality of child care, especially for children from lower-income families? Our answer to each of these questions is "yes."

Does Child Care Quality Matter?

Our review of the research literature indicates that child care quality "matters" at several levels. In terms of children's everyday experiences, children appear happier and more cognitively engaged in settings in which caregivers are interacting with them positively and in settings in which child:adult ratios are lower. There also is evidence of concurrent relations between child care quality and children's performance in other settings. Children who attend higher-quality child care settings (measured by caregiver behaviors, by physical facilities, by age-appropriate activities, and by structural and caregiver characteristics) display better cognitive, language, and social competencies on standardized tests and according to parents, teachers, and observers. Finally, there is evidence that child care quality is related to children's subsequent competencies. The relationship is more evident when cumulative measures of child care quality are analyzed, rather than one-time assessments, and when quality and child outcome measures have strong psychometric properties.

$18,000 respectively.

Does the Quality of Child Care Need to Be Improved, and Can It Be Improved?

Two general approaches to measuring child care quality were described in this report. Process quality refers to children's experiences in child care settings. Some process measures focus specifically on caregivers' behaviors with children. Others include global ratings that incorporate physical facilities and age-appropriate child activities as well as caregiver behavior into their evaluation. Multisite studies suggest considerable need for improvement of process quality in the United States. Although less than 10 percent of process quality has been categorized as "inadequate" or "poor," most settings have been characterized as only "fair" or "minimal." These observations indicate the need for systematic efforts to improve a substantial portion of child care in the United States.

A second way of measuring child care quality is in terms of structural and caregiver characteristics, such as child:adult ratio, group sizes, teacher formal education, and teacher specialized training. There is an extensive research literature linking structural and caregiver characteristics to process quality. A review of regulatory standards in the 50 states shows that few states have adopted standards that are consistent with the recommendations of professional organizations. Furthermore, reports from nationally representative surveys indicate that average group sizes and ratios exceed recommended standards. Recent evidence suggests a decline in the educational background of staff during the 1990s, perhaps as a result of low wages. Thus, it appears that child care structural and caregiver characteristics are in need of improvement. They can be improved if additional resources are allocated. This could occur through a combination of increased subsidies for care, especially to low-income families; federal standards and/or increased state standards for both physical settings and caregiver training and child:staff ratios, improved information to parents on the quality of providers, and/or direct provision or expansion of child care in schools.

Is There an Economic Justification for Public Intervention to Improve the Quality of Child Care, Especially for Children from Lower-Income Families?

Market failure, the presence of externalities, and an argument for equality of opportunity all call for public sector intervention in the child care market. The primary form of market failure is the lack of information for parents regarding quality of care which is tied to the difficulty in measuring quality, the lack of availability of high quality care, and the need for child care for irregular hours such as weekend and late shifts.

Benefits of quality child care accrue to other members of society, including all children in schools with children who had child care; taxpayers, who are likely to save in costs of future schooling by reduction in special education and grade retention; employers, who benefit from more productive employees; and citizens, who gain in terms of future reductions in crime and use of transfer programs. Subsidizing child care for low-income families is also consistent with the goals of the 1996 welfare reform and an ideology that wishes to encourage and reward work. Finally, to the extent that high-quality child care provides benefits to children and their families, there is an argument for providing equal opportunity for such programs to children in low-income families.

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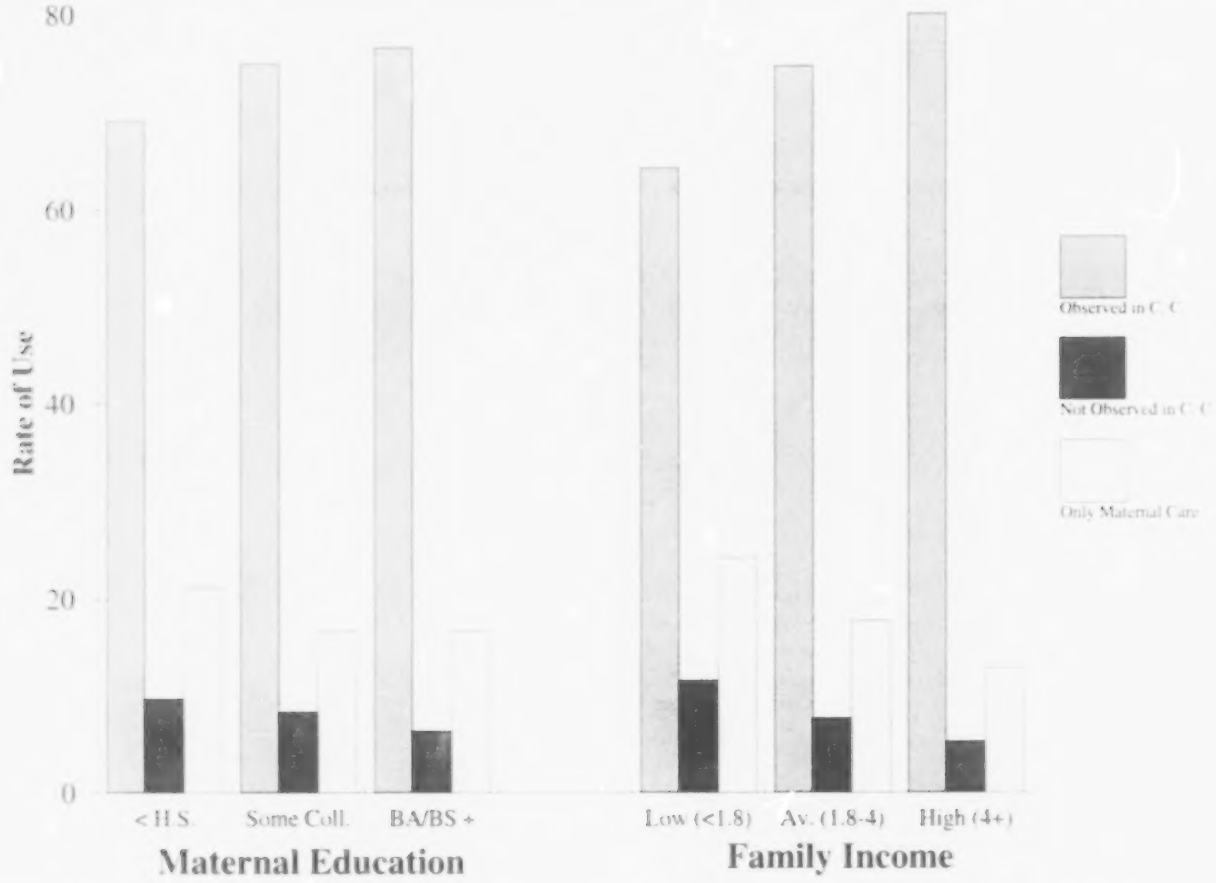
Figure 1
Child Care Usage by Maternal Education and Family Income During the Child's First Three Years



Source: NICHD, Early Child Care Research Network, in press-b.

Figure 2

A Conceptual Model Of Relations Between Child Care Quality And Children's Developmental Outcomes

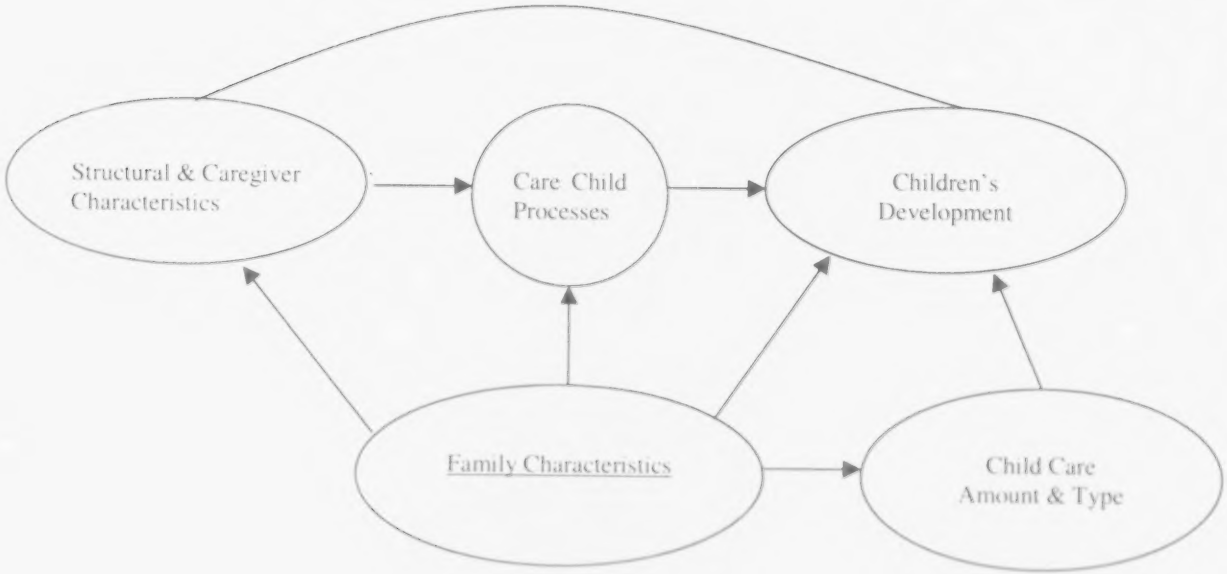
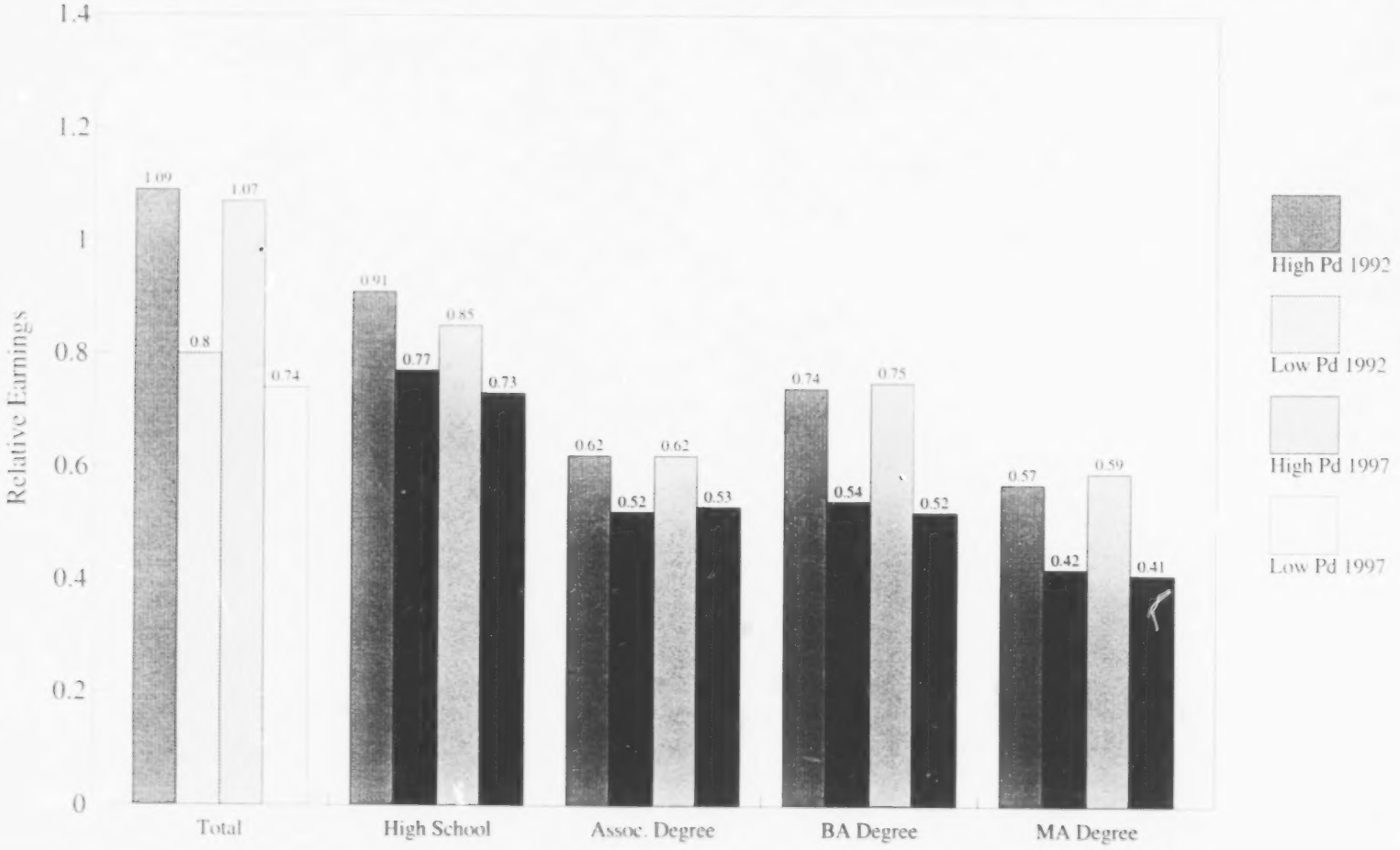


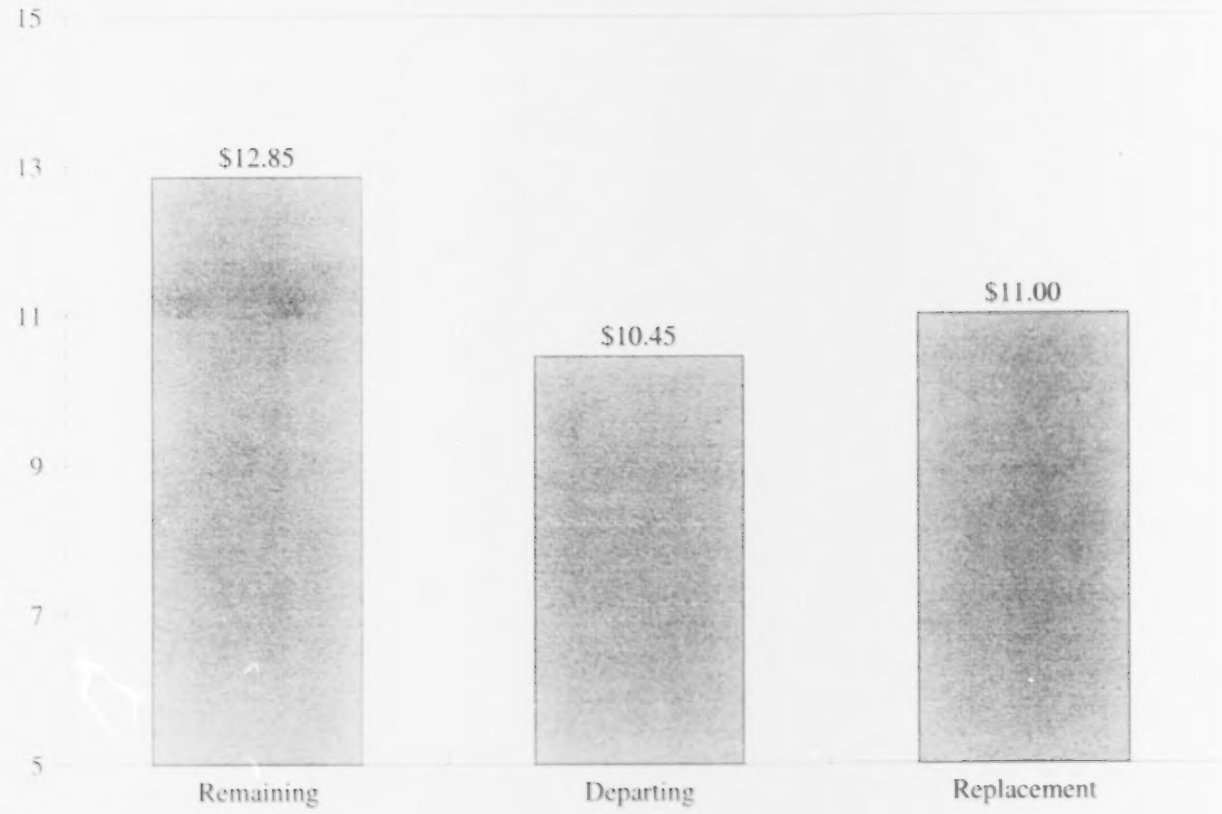
Figure 3

Median Earnings of Highest & Lowest Paid Teachers or Assistants Relative to Full-Time Wages of Women 25+; 1992, 1997



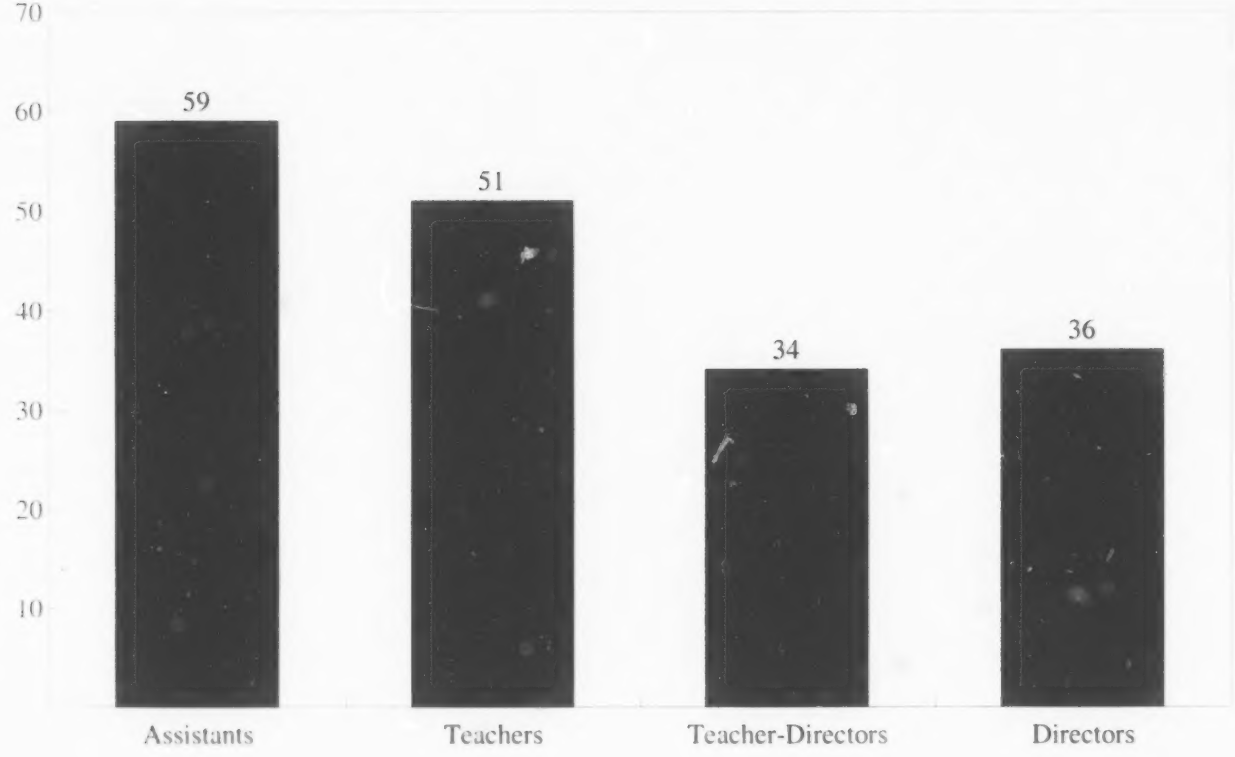
Source: U.S. Bureau of Census, 1999, and Whitebook, Sakai, and Howes, 1997.

Figure 4
Staff Turnover by Prior Year's Wages



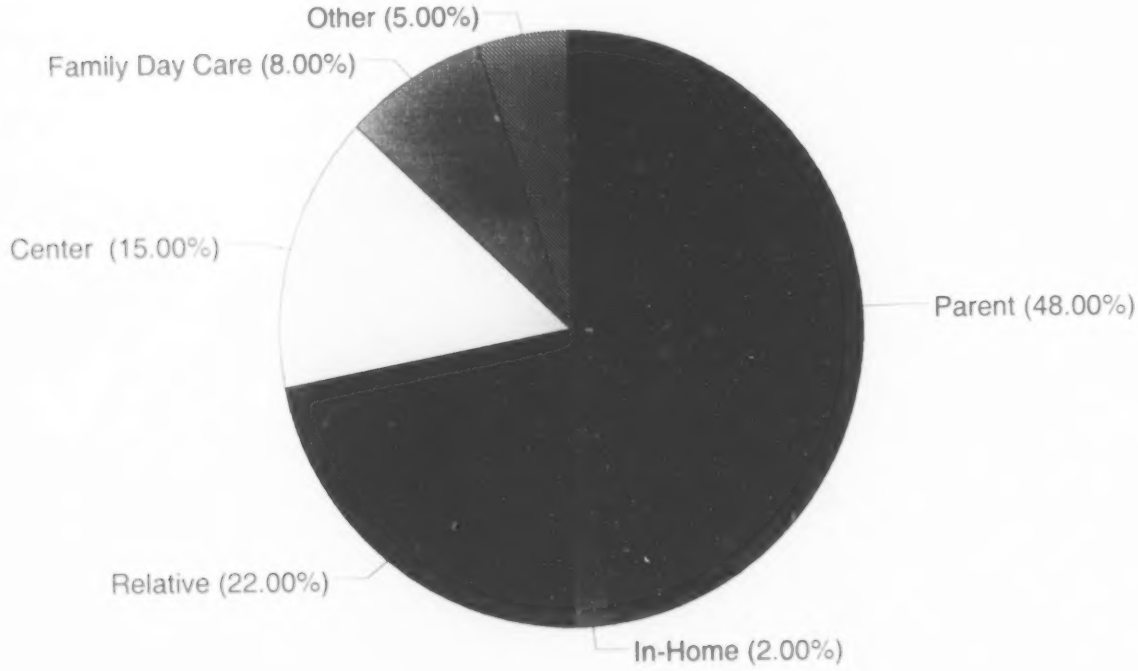
Source: Whitebook, Sakai, and Howes, 1997.

Figure 5
Turnover Rates, All Staff, All Centers *



Source: Whitebook, Sakai, and Howes, 1997
** Rates derived from 2 visits, 20 months apart to centers*

Figure 6
Main Child Care Arrangements of Low-Income Children under Age 5



Source: Phillips, 1995

Figure 7
A Conceptual Model of Public Policy, Parental Resources, and Inputs into Child Care Quality

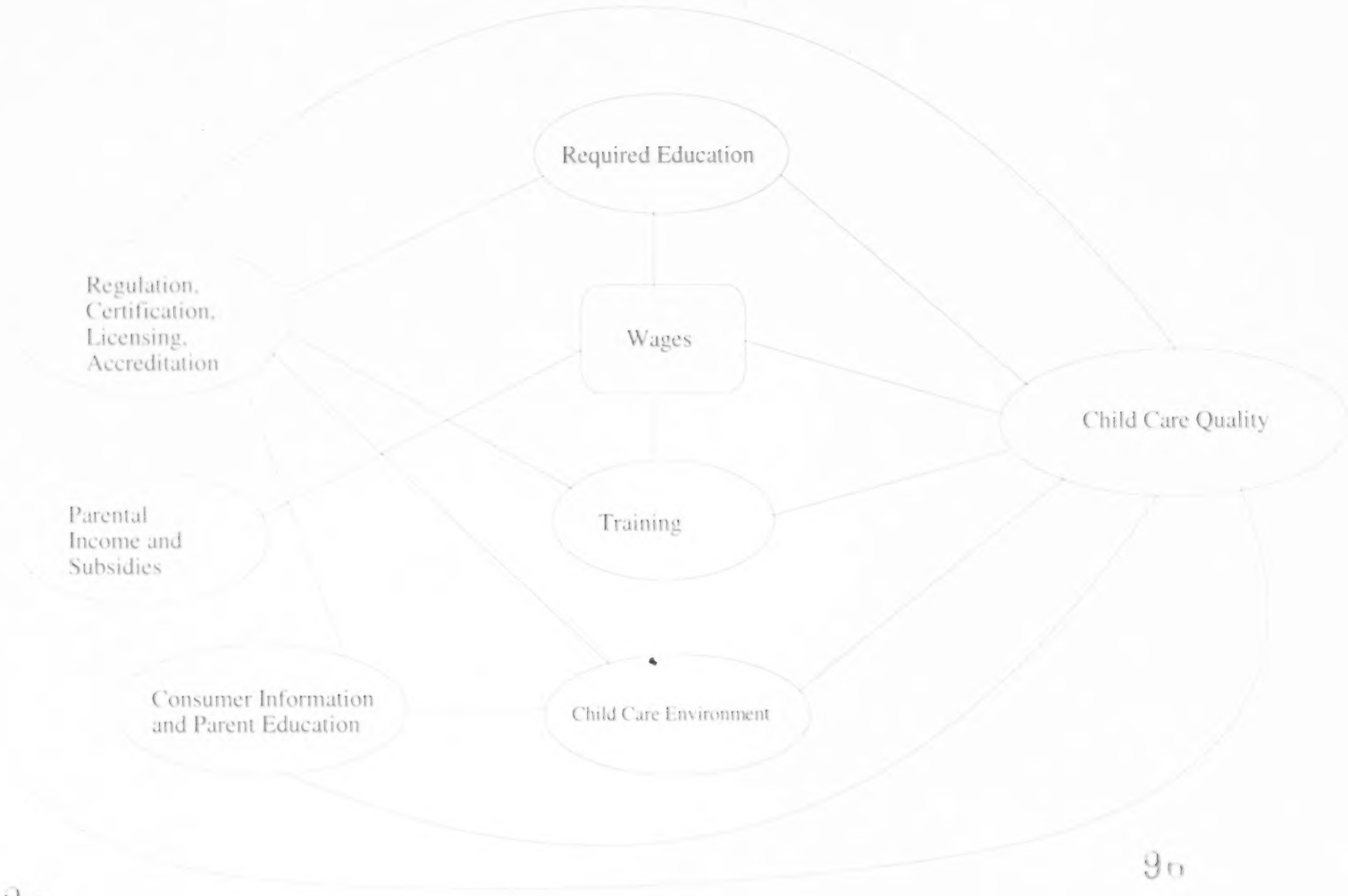
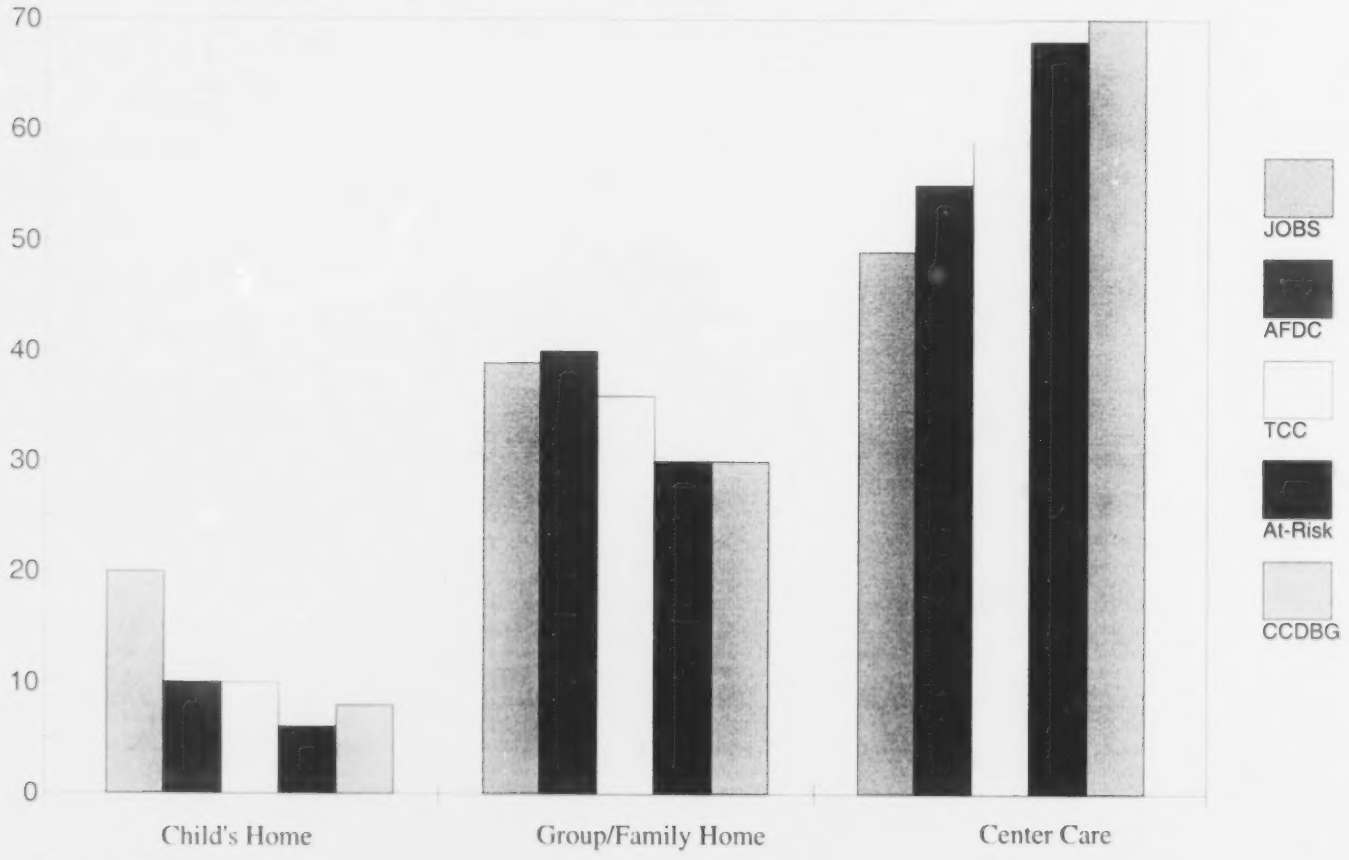


Figure 8
Children Served, by Federal Program and Type of Provider



Source: Phillips, 1995.

Table 1

THE RELATIONSHIP BETWEEN STRUCTURAL VARIABLES AND PROCESS VARIABLES

CITATION[a]	N	TYPE OF CARE	STRUCTURAL VARIABLES	PROCESS VARIABLES[b]	ANALYSIS	FINDING
Arnett (1989)	59	Centers	CG[1] training (1. No training, 2. 2 courses Bermuda college, 3. 4 course training prog, 4. 4-yr college degree in ECE[2]	Parental Modernity Scale CIS (Positive Interaction, Punitiveness, Detachment, Permissiveness)	ANCOVA	CG[1] w/ half or all the Bermuda College training less authoritarian in childrearing attitudes than cg w/ no training, rated higher on positive interaction and lower on detachment in interactions w/ children CG[1] w/ 4-yr ECE[2] degree diff from other 3 gps: childrearing attitudes less authoritarian, interact w/ children rated higher on Pos Interact and lower on Punitiveness & Detachment
Berk (1985)	37	Centers	CG formal education & CG specialized training	Observations of caregiver behavior	ANOVAs and correlations	College educated caregivers had more encouraging behaviors, more suggestions, less restrictive actions.
Blau (in press)	548 classrooms (reanalysis of CQO data)	Centers	Group size, ratio, CG experience, job tenure, ethnicity, formal education, specialized training	ECERS, ITERS	Pearson correlations, Regressions with and without a fixed effect control for center ID	Simple correlations and regressions that did not include the fixed effect center control found lower group size, lower C:A ratio, and more CG training to be related to better ECERS scores; these relations were substantially reduced when the center fixed effect control was added to the model
Burchinal, Howes, & Kontos (in press)	Total=244 Florida Child Care Study=144 California Licensing Study=100	Family Child Care	CG[1] Education, Formal and Informal Training experiences, experience as a child care provider, group size, business practices Points(sum of number of children, weighted by age of children)	FDCRS, CIS	Pearson Correlations Regression	CG[1] ed & experience better predictors of cc quality than C:A Ratios. CG[1] w/ more ed→more sensitive & rated higher on global quality. More experienced CG[1] slightly more detached and provide lower quality care CG w/ more education tended to have settings w/ higher global quality ratings CG experience was negatively related to observed quality in the licensed Family Child Care Study Group size or ratio not related to observed quality of care.
Burchinal, Roberts, Nabors, & Bryant (1996)	79	Centers	Director & observer reports of group size & C:A ratio, Teacher report of training & experience	ITERS	Pearson correlations	Higher observed & reported C:A ratios were associated with lower ITERS scores Higher CG training was associated with higher ITERS scores
Burchinal, et al. (in press)	27	Centers	C:A Ratio[3], CG[1] Education, Group Size	ITERS, ECERS	Pearson Correlations	Higher C:A Ratios[3] were related lower global quality at 12 mos, 24 mos, & 36 mos Higher group size were related to lower global quality at 24 mos & 36 mos Higher teacher education was related to higher global quality at 12 mos & at 36 mos

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Table 1, continued

Clarke-Stewart, et al. (2000)	15 mos=133 24mos=146 36 mos=131	Child Care Homes	Group Size, Group Size Points, CG[1] Education, Amount of specialized training, recent training	ORCE-Positive Caregiving HOME	Correlations HLM	Both correlational analyses & HLM analyses indicated overall quality of care measure by CC-HOME & by ratings of obs CG[1] behavior was higher when CG[1] were more highly educated, had more specialized training pertaining to children, and had received training in the past year, with the strongest effects evident at 36 mos. CG[1] exhibited more pos caregiving when group sizes were smaller
Dunn (1993)	30	Day Care Centers	CG[1] Education, Child Major, Training, Center Exp[4], Field Exp[4], CG[1] Age, Group Size, C:A Ratio[3], ECERS	Play Space, Variety, Divergent/Elaborative Interact, Praise/ Nurturance/ Redirection, Clear Limits, Total Limits	Pearson Correlations	CG with more experience in the field and larger group sizes was positively related higher ECERS scores. Larger Group Sizes was positively related to more variety in classes. Higher ECERS scores were related to more divergent/elaborative interactions, and less total limits.
Dunn et al. (1994)	30	Day Care Centers	Group Size, C:A Ratio[3], CG[1] Education, CG[1] Exp[4] in Field, CG[1] Exp[4] in Centers, CG[1] Certification	Lang/Reasoning (ECERS), Dev Approp Act (ECERS), Variety, Literacy Act, Literacy Quality	Pearson Correlations Simultaneous Regression	Only one structural quality variable correlated w/ quality of environment. CG who held some form of teacher certification provided classes rated higher on literacy quality scale
Elicker, Fortner-Wood, & Noppe (1999)	23	Family Day Care	Group Size, C:A ratio[3]	Caregiver-Infant Involvement-AQS	Pearson Correlations	Smaller group size and less children per adult→ more CG-Child Involvement CG yrs experience, CG educational level, income, overall work satisfaction, work-related stress, control over work sched, work & family conflict not sig corr w/ CG-Child Involvement or Infant-CG attachment
Goelman (1988)	74	Center Day Care Family Day Care	Caregiver Education	Learning Activities, Social Development, Language Development, Creative Activities, Total Quality	Pearson Correlations	Higher CG Education was correlated with higher total quality scores in both family day care and center day care
Holloway, & Reichart-Erickson (1988)	15	Preschools & Day Care Centers	Group Size, C:A Ratio[3]	ECOI	Pearson Correlations	Smaller group sizes were related to higher ratings on the Interaction Quality Composite and accommodation of varied groups. C:A Ratio was not related to any ECOI Indicators.

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Table 1, continued

Howes (1983)	40	Center Day Care & Family Day Care	C:A Ratio[3], Group Size, # Adults, CG[1] years experience, training child development	CG[1] Beh (facilitative social, express pos affect, neg affect, restrict, responsivity)	Pearson Correlations	Caregivers in both settings w/ fewer children in their care, who worked shorter hours, w/ less housework responsibilities engaged in more facilitative social stimulation, expressed more positive affect, were more responsive, and less restrictive and negative. Family day care caregivers who worked in spaces specifically designed to be safe & appropriate for children were less restrictive of toddler activity.
Howes (1997)	Total=1065 Cost, Quality, Outcome Study(CQOS) =655 Florida Quality Improvement Study(FQIS)=410	Child Care Centers	C:A Ratio[3], CG[1] Education, CG[1] ECE[2] Training	CIS, AIS	ANOVA	**CQOS**: CG[1] w/ BA or beyond degrees in ECE[2] rated more sensitive than CG w/ AA degrees in ECE[2], who were more sensitive than CG[1] w/ other bkgds. CG[1] w/ at least AA degree less harsh than CG[1] in other bkgds. CG[1] in classes in compliance w/ ratio standards rated more sensitive, less harsh, & less detached. **FQIS**: CG[1] w/ at least BA in ECE[2] rated more sensitive than CG[1] w/ CDA training who were rated as more sensitive than all other CGs[1]. **Caregivers w/ most advanced education→most effective**
Howes & Rubenstein (1985)	50 Home=23 Center Daycare=11 Family Daycare=16	Home, Center Day Care, Family Day Care	C:A Ratio[3] Group Size	Caregiver-Child Interaction (Talk & Play, Restrict & Cry, Touch & Laugh)	Pearson Correlations One-Way ANOVA	Lower C:A Ratio predicted quality of CG[1] -child interaction (i.e., social interactions-talk & play, touch & laugh, & less restrict & cry). C. at home, in high C:A ratio[3] FDC, & high C:A ratio[3] CDC-->higher Restrict & Cry than in low C:A ratio[3] FDC. Smaller group sizes & lower C:A ratios→higher Talk & Play & higher Touch & Laugh, less Restrict & Cry than children in larger groups & higher C:A ratios
Howes & Smith (1995)	150	Child Care Centers	CG[1] char (yrs ed + specialized training in ECE[2]), C:A Ratio[3], Group Size	ITERS, ECERS	Pearson Correlations	Classes w/ more educated & trained teachers→higher ITERS & ECERS scores. Infant-toddler classes w/ more educated & trained teachers→smaller group size. Preschool classes w/ more educated & trained teachers→smaller group size & fewer children per adult

Table 1, continued

Howes, Phillips, & Whitebook (1992)	143	Child Care Centers	C:A Ratio[3], Group Size	Appropriate Caregiving, Developmentally Appropriate Activities	Chi-Square	Higher Child-Adult Ratios were in classrooms rated as inadequate in caregiving & rated as inadequate in activities. Children in classes w/ better ratios than children in classes w/ worse (higher)ratios experienced both caregiving & activities rated as good or very good. Large group sizes were more likely to be rated as inadequate in caregiving and inadequate in activities. However, Smaller group sizes were also rated as inadeq in activities. Children in classes w/ smaller group sizes were more likely than children in classrooms exceeding these standards to experience developmentally appropriate activities. No association between group size and appropriate caregiving.
Howes, Whitebook, & Phillips (1992)	1300	Child Care Centers	CC[3] Experience, Specialized Training, Education	ECERS, ITERS, Arnett Teacher Sensitivity Measure	Pearson Correlations Multiple Regression	CG^1 Experience not good predictor of CG^1 behavior. More formal education & more specialized child-related training→CG^1 behaviors Formal education better predictor than specialized training. Infant/Toddler CGs^1 need more college-level specialized training than preschool teachers to be competent teachers.
Iutcovich, J., Fience, R., Johnson, J., Koppel, R., & Langan, F. (1997)	675 Center=561 Group Home=70 Family=44	Center, group home, family	CG^1 Education, CG^1 yrs in field, CG^1 salary, CG^1 long term ed goal, Training Characteristics, Organizational Climate	ITERS, ECERS, FDCRS	Pearson Correlations	Higher CG^1 Salary→higher ITERS & ECERS scores Younger CG^1, CG^1 w/ more long term ed goals, evaluating appropriateness, and evaluate usefulness → higher FDCRS score CGs^1 w/ higher long term educational goals, more likely to evaluate appropriateness & usefulness→Higher FDCRS scores CG^1 higher ratings of Professional growth, Clarity, Reward System, Goal Consensus, & Task Orientation→Higher ECERS Scores
Kontos, S., Howes, C., & Galinsky, E. (1996)	Training Group=130 Regulated Providers=112	Family Day Care	CG^1 Training, C:A Ratio[3], Group Size	Process Quality: Arnett Scale of Provider Sensitivity, Adult Involvement Scale Global Quality: FDCRS	Chi-Square/t-test	The training group & the comparison group were similar on structural, process, and global quality. Providers in comparison gp cared for slightly more children per adult than training group. Effects of training→no changes in Process quality Effects of training→increased global quality in 2 of 3 sites.

Table 1, continued

NICHD Early Child Care Research Network (1996)	576	Center, child care homes, in-home sitters, grandparents, fathers	Group Size, C:A Ratio[3], Physical Environment CG[1] Characteristics (formal ed, specialized training, child care experience, beliefs about childrearing)	ORCE: Caregiver Interactions	Pearson Correlations & Multiple Regression Analyses (backward elimination procedure)	Caregivers rated as providing more positive caregiving when group sizes and C:A ratios[3] were smaller & when cg held less-authoritarian beliefs about child rearing. Small group sizes, low C:A ratios[3], CG[1] nonauthoritarian child-rearing beliefs, and safe, clean & stimulating physical environments consistently associated with positive caregiving behaviors within each of the different types of settings.
NICHD Early Child Care Research Network (in press-a)	612	Center, child-care homes, in-home sitters, grandparents, fathers	C:A Ratio[3], Group Size, CG[1] Education, CG[1] Specialized Training, CG[1] Beliefs, CG[1] Experience	ORCE (Positive caregiving frequency, Positive caregiving quality) Global quality rating	Pearson Correlations & Simultaneous Multiple Regression	Across all 3 ages (15, 24, & 36 mos) & types of care, smaller group sizes, lower C:A ratios[3], CG[1] had higher level of education, CG[1] held more child-centered beliefs about childrearing, & more experience in child care, and environments were safer & more stimulating→positive caregiving more likely. CG[1] child care exper & specialized training not correlated any ages. MR: Pos caregiving ratings sig higher when CG[1] had more child-centered beliefs (all ages), higher levels of ed & more experience providing care (at 24 & 36 mos), & more specialized training (15 mos), & when lower C:A ratio[3] & smaller gp sizes (15 & 24 mos)
Phillipsen, Burchinal, Howes, & Cryer (1997)	749 Total 228=I/T 521=P	Child Care Centers	CG[1] Background (Ed Level & Exper), Class Struct (C:A Ratio[3] & Group Size) CG[1] Ed x A:C Ratio[3], lead CG[1] wages, center struct, direct bkgd, econ char center, state, & sector	ITERS, ECERS, TIS, CIS	MANOVA Hierarchical Regressions	Structural measures predicted process quality more strongly in preschool than infant/toddler classes Infant/Toddler: process qual higher in classes w/ mod exper & better pd teachers, & more experienced directors. Preschool: process quality higher in classes w/ CG[1] w/ more education, moderate amount experience, & higher wages. Better C:A ratios[3], lower center enrollment, & lower proportion of Infant/Toddler & subsidized children in center also predicted higher process quality for preschool. Teacher wages strongly related to process quality in infant/toddler & preschool.
Ruopp, Travers, Glantz, & Coelen (1979)	Natural study (n = 64) Quasi-experiment (n= 57)	Centers	C:A Ratio, group size, CG yrs education, child related training, education, physical environment	Caregiver behaviors including management, social interaction, child aimless wandering	Correlations	Smaller group sizes = more teacher-child interaction, less child aimless wandering Smaller C:A ratios = less time in child behavior management More child-related education = more teacher-child interaction.

Table 1, continued

Scarr, Eisenberg, & Deater-Deckard (1994)	363	Child Care Centers	C:A Ratio[3], Group Size, CG[1] Training in child dev & child care, CG[1] educ, highest wage pd to a CG[1] in the center, staff turnover	ITERS, ECERS, APECP	Pearson Correlations	Highest CG[1] wages was highly correlated w/ process measures of quality (ITERS/ECERS & Profile Score) Lower C:A ratios[3], more teacher education, and more teacher training were correlated w/ higher process measures of quality, however, less correlated w/ process quality criteria
Stallings & Porter (1980)	303	Child-care homes, included sponsored, regulated, and unregulated homes	Observed C:A ratio.	Specific caregiver behaviors including teaches, plays, directs, converses, comforts, tends to physical needs, housekeeping, not involved	Pearson correlations Multiple regressions	Larger child:adult ratios associated with less caregiver teaching, playing with child, and facilitating child activities; larger child:adult ratios associated with more efforts to control child behavior. These relations were stronger when focal children were less than 35 months of age. Limited significant relations were found with caregiver education. The obtained associations indicated that less educated caregivers were more directive.
Stith & Davis (1984)	30	Employed moms, substitute CG[1] unemployed moms	Group Size	Yarrow, Rubenstein & Pedersen's (1975) infant environment observational scale	Pearson Correlations	Larger group sizes→ less expression of positive affect & less contingency of responses to distress.
Vandell & Powers (1983)	53	Center	Structural composite (C:A Ratio[3] & toys accessible +CG[1] education+space allotment per child	Positive & Negative behavior w/ adults, total adult-directed behavior	ANOVA	Better C:A Ratio[3], higher CG[1] education, & more toy availability→ more likely than children in low to moderate quality care to interact w/ adults (positive behavior, positive vocalizations, total behavior)
Volling & Feagans (1995)	36	Center	Group size C:A ratio	Positive adult-child interaction Nonsocial activity, positive peer interaction, negative peer interaction	Pearson correlations	Smaller group sizes and C:A ratios related to children having more time in positive staff-child interactions and less time in nonsocial activities. Larger C:A ratios were related to more frequent negative interactions with peers.

[2]Full citations available in Reference Section

[1]Process Quality Measure Acronyms are Alphabetized. **AIS**: Adult Involvement Scale; **APECP**: Assessment Profile for Early Childhood Programs; **AQS**: Attachment Q-Set; **CIS**: Caregiver Interaction Scale; **ECERS**: Early Childhood Environment Rating Scale; **ECOI**: Early Childhood Environment Rating Scale; **FDCRS**: Family Day Care Rating Scale; **HOME**: Home Observation for Measurement of the Environment; **ITERS**: Infant/Toddler Environment Rating Scale; **ORCE**: Observational Record of the Caregiving Environment; **TIS**: Teacher Involvement Scale

[3]**CG**=Caregiver; [4]**ECE**=Early Childhood Education; [5]**C:A Ratio**: Child Adult Ratio; [6]**Exp**: Experience; [7]**CC**: Child Care

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Table 2
CONCURRENT ASSOCIATIONS BETWEEN CHILD CARE QUALITY AND CHILD DEVELOPMENTAL OUTCOMES

CITATION[a]	N	AGE	PROCESS QUALITY MEASURE[b]	STRUCTURAL QUALITY MEASURE[b]	FAMILY CONTROLS	CHILD DEVELOPMENTAL OUTCOMES[c]	QUALITY FINDINGS
Burchinal, Roberts, Nabors, & Bryant (1996)	79	12 mos	ITERS	Group Size, C:A Ratio[1], training experience		MDI (Cog) SICD-R & CSBS: (Language Skills)	ITERS related to better cognitive development, language & communication skills better C:A Ratio[1] related to higher Bayley scores, more advanced receptive language development & communication skills. Better Educated CG[1]→children higher on expressive lang Better ProcessQuality→advanced cognitive development Better Structural Quality→advanced language development
Clarke-Stewart, Vandell, Burchinal, O'Brien, & McCartney (2000)	242 @ 15-m 248 @ 24-m 201 @ 36-m	15m – 36m	ORCE CC-HOME	Group size, "points", CG education, specialized training, recent training	Family income Observed maternal sensitivity	Bayley MDI, Bracken School Readiness, Reynell language, mother & CG report of social competence, mother & CG report of behavior problems	Controlling for income and sensitivity, better process quality (ORCE & CC-HOME) related to better cognitive scores, better language comprehension, and more cooperation. Caregiver education and training was associated with better cognitive and language scores, controlling for family income and education
Dunn (1993)	60	51.85 mos	ECERS Goals, strategies, & guide childs emotional development	Group size, C: A Ratio[1], CG[1] education, CG[1] center exper[4], CG[1] field exper[4], CG[1] age	Child Age, SES[7], parental age & education, day care history	CBI: (Soc& Intelligence) PBQ: (Soc comp) PSI: (Cog) PPS (soc play) CPS & POS (cog play)	Structural variables (CG[1] w/ less experience in center)→children rated more sociable. Struc & Process vars corr w/ c's intelligence. HMR (controls: child age, DC[6] hist, SES, parent age & education): higher quality (ECERS), CG[1] child major, less exper[4] in the center→higher CBI intelligence
Dunn, Beach, & Kontos (1994)	60	51.85 mos	ECERS Language & reasoning envir Physical envir & available learning activities	CG[1] education training, certification, experience, C:A Ratio[1], group size	SES[7]	CBI: (Language) PSI (Cognitive)	Achievement not related to DC[6] quality Higher quality DC[6] (developmentally appropriate activities)→ more advanced language HMR controlling for SES[7]: DC[6] quality (developmentally appropriate activities) predicted children language development Children's language development positively correlated quality, but not literacy related activities. HMR literacy environment predicted significant portion children's language development controlling for SES[7]
Elicker, Fortner-Wood, & Noppe (1999)	41	14.8 mos	FDCRS	CG[1] exper[4] caring for infants & toddlers, group size, income		AQS: (Attachment) Adult-Child IRS: (CG-Child Involvement)	Smaller group size & smaller C:A Ratio[1] predicted more infant-CG[1] interactive involvement. Higher global CC[5] quality was related to better infant-CG[1] attachment security. , but not interactive involvement
Goelman (1988)	105	CDC = 50.5 LFDC=38.3 UFDC=39.8	ECERS DCHERS COF			PPVT-R EOWPVT (Language)	Higher global quality in family day care (DCHERS) significantly predicted higher children's PPVT and EOWPVT scores.
Hausfather, Toharia, LaRoche, & Engelsmann (1997)	155	55 mos	ECERS ECOS	ECOS		SCS: (Soc Comp) PBC: (Beh Probs)	Low quality DC[6] significantly contributes to children's anger & defiance. HMR: additive risk for aggressive behavior (early entry to DC[6], low quality stress in parenting, males, stressful life events). High quality→no relation w/ behavior problems. HMR: high quality, early attendance, favorable family circumstances→ children's level of interest & participation Quality of care mediates positive or negative effects of age of entry

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Table 2, continued

Hestenes, Kontos, & Bryan (1993)	60	52 mos	ECERS Teacher Engagement	C:A Ratio[3], Group size	Gender SES[7]	BSQ: (Emotional Expression, Temperament)	MR: DC[4] quality predicted measure of affect acting for temperament (controlling for SES[7] & gender). In DC[4] centers w/ more appropriate caregiving the children displayed more positive affect. Neither structural related to affect High level CG[1] engagement→children had higher intensity positive affect. More low level CG[1] engagement→children display more intense negative affect
Holloway, Reichhart-Erickson (1988)	55	53 mos	Early Childhood Observation, Process Composite	Class size, C:A Ratio[3], # hrs substitute care	SES[7]	SSPS (Soc Prob Solv)	Children in high quality interaction w/ CG[1]→more prosocial responses &mentioned more prosocial categories. In larger classes,children gave more antisocial responses & used more antisocial categories. Children in classes w/ larger C:A ratios[3] spent less time in solitary play. Controlling for SES[7], most still remained signficant.
Howes (1997) Study 1	760	4.25 yrs	CIS, AIS	C:A Ratio[3], group size, ECE[2] training, CG[1]education		Language, Pre-Academic, Social Development	CG[1] w/ at least AA in ECE[2]→higher PPVT-R scores, children in classes complying w/ C:A Ratio[3]→higher prereading
Howes (1997) Study 2	410		CIS, AIS, T. behs	CG[1] background in ECE[2]		Cognitive play, Peer play	CG[1] w/ BA or Child Development Associate→greater child language, play & most complex play w/ peers, most language activity CG[1] w/ BA ECE[2]→children engaged in most complex play w/ objects & more creative activities
Howes & Olenick (1986)	89	18, 24, 30, & 36 mos		Low qual (higher C:A Ratios[3], no formally trained CG[1], < 2 primary CG[1]		Compliance Control	**High quality centers→children more compliant & less resistant, & children more likely to self-regulate. Low quality centers & at home, self-regulation increases w/ age** M.R.: for girls compliance best predicted by combination of high quality DC[4], low life complexity, & low parental involvement. Task-resistance best predicted by combination of low quality DC[4], high life complexity, & high parent involvement. CC[5] Quality best predicted self-regulation in boys. *Low qual care missing dev approp experiences to promote compliance & self-regulation*
Howes & Smith (1995)	840	34.07 mos	ECERS, ITERS, AIS, Attachment			Cognitive Activity Scale	HMR: (1) positive social interact w/CG[1], attachment, & play activity (2) ECERS or ITERS. Classroom quality did not result in sig R^2 change. Quality→indirect effect
Howes, & Stewart (1987)	55	20.2 mos	Family Day Care Rating Scale, Adult Play w/ Child Scale	C:A Ratio[3] & Group Size	Family Characteristics (nurturance & support, restrict & stress)	Peer Play Scale Play w/ Objects Scale	Girls: controlling for family characteristics (nurturance & support, restrict & stress), higher quality CC[5]→higher level play w/ peers, objects, & adults, Boys: controlling for family characteristics: higher quality care→higher play w/ objects.
Howes, Phillips, & Whitebook (1992)	414	14-54 mos	ECERS Infant-Toddler Envir Rating Scale, Dev approp activ	C:A Ratio[3], group size		AQS- (Attachment) Peer Play Scale (Soc Orient, Interact w/ peers)	CG[1] who practiced more appropriate caregiving→child more secure with CG[1] CG[1] engaged in more developmentally appropriate activities→children were more socially oriented w/ CG[1] Regulatable quality on social competence mediated through process quality variables & thru childrens relationship w/ adults & peers. Process mediated through children's relationship w/ adults & peers rather than direct influence on peer competence

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Table 2, continued

Kontos (1991)	138	53 mos	Overall envir quality, COFAS, ECERS	C:A Ratio[1], Group Size, CG[1] Training, Child Development Program Eval-Indicator check	Child age Child Care history	Language, Intelligence, Social, Behavior Problems	**Higher quality CC→poorer intelligence, & poorer language** HMR (child age, CC[2] history controls): quality did not predict language or intellect, Family Background did. HMR (child age, CC[2] history control): higher quality CC[3] (CDPE-IC: structural measure)→children better socially adjusted, & more sociable
Kontos, & Wilcox-Herzog (1997)	114	51.7 mos	CG[1] Responsive Involvement CG[1] Verbal Stimulation		Child Age	Cognitive Competence Social Competence	**Controlling for child age, more CG[1] involvement→lower cognitive competence, but not social competence even when controlling for age. Check p.257** MR: More contact w/ CG[1] & more CG[1] involvement→higher social competence. Less contact w/ CG[1] & more involvement in high yield activities→higher cognitive competence.
McCartney (1984)	166	36-68 mos	DCEL ECERS		Child Age, Parent as Educator Interview (values conformity, values social)	PPVT-R, PLAI, ALI, Experimental Communication Task	HMR: Controlling for child age, values conformity, & values social, higher total quality of center care scores (ECERS)→children had higher PPVT, PLAI, ALI scores & performed better on the communication task. Quality of DC[4] →positive effect on language development. Controlling for total # functional utterances by CG[1] to child, family background & group care experience, more verbal interaction w/ CG[1]→ higher PLAI, ALI scores & better performance on communication task.
McCartney, Scarr, Phillips, & Grajek (1985)	166	2 years	ECERS, verbal interact w/ CG[1]	C:A Ratio[1]		PPVT-R & ALI: (Intellect, Lang) CBI & PBQ: (Social Skills)	Intervention Center highest quality rating. Intervention Center higher language, IQ, & Social ratings than other centers.
McCartney, Scarr, Rocheleau, Phillips, & Abbott-Shim (1997)	718	Infant=14.7 mos Toddler=27 mos Preschool=47.9 mos	ECERS, ITERS, CG[1]-C Interaction		Mothers education	AQS & Separation-Reunion Quest: (Attachment) CBS Q-sort (Social Behavior, Behavior Problems; Harter: (Competence & Social Accept)	Partial correlations, controlling for mom education, more CG[1]-C interaction related to more social bids (Toddlers & Preschoolers), more solitary play (Preschoolers) & fewer CG[1] ratings of negative separation/reunion for Toddlers. HMR: CG[1]-C interactions not related to child outcomes
NICHD ECCRN (1999-a)	97 118 163 250	6 mos 15 mos 24 mos 36 mos	None	C:A Ratio[1], observed group size, CG[1] training, CG[1] education	Income to needs, maternal education, concurr single –parent status, child gender, maternal sensitivity	Bayley MDI Bracken School Readiness Reynell Dev Lang CBCL, ASBI (Soc Beh)	Outcomes (cognitive, language, & social) better when children attended classes meeting recommended C:A Ratio[1] at 24 mos & CG[1] training & CG[1] education at 36 mos. More standards met, better school readiness, language comprehension, & less behavior problems at 36 mos. Older children more likely to be in classes meeting recommended standards.
Peisner-Feinberg, & Burchinal (1997)	757	M = 4.3 yrs	ECERS, CIS, AIS, UCLA ECOF		Mothers education, ethnicity, & child gender	PPVT-R, WJ-R (prereading, pre-math), CBI (Social skills)	Controlling for child & family characteristics, the observed quality index & the STRS CG[1]-child closeness score related to better PPVT-R scores (both quality indices), better WJ-R prereading scores (individually, observed quality index), better CG[1] ratings of child's cognitive/attention skills on CBI (individually CG[1] rating of closeness), and fewer behavior problems (individually, CG[1] rating of closeness), & higher sociability ratings. Higher quality CC[5] → better language, preacademic, sociability, & fewer behavior problems.

Table 2, continued

Phillips, McCartney, & Scarr (1987)	166	36-68 mos	ECERS, DCEI	C:A Ratio[3], Directors years experience		CBI, PBQ (Social dev)	Higher overall quality→ higher social competence ratings. Better C:A Ratio[3]→ higher social competence ratings, but lower social adjustment (anxious). More CG[1]-C interaction → better social competence ratings
Ruopp, Travers, Glantz, & Coelen, 1979	Natural Study = 64 centers Experiment = 57 centers	3 & 4 yr olds	Observations of staff-child interactions, Observation of child behavior	C:A Ratio, group size, staff education, training	Looked at changes in child performance over time as a function of systematic changes in ratio and staff training	Preschool Inventory (PSI), Peabody Picture Vocabulary Test (PPVT-Revised)	Children had larger gains on the PSI and the PPVT when groups were smaller. Centers with higher proportions of caregivers with child-related training had greater gains on the PSI.
Schliecker, White, & Jacobs (1991)	100	4 yrs	ECERS		SES[7]	PPVT-R (Verbal)	Controlling for SES[7], higher center quality→ higher PPVT Family Structure analyses: *2 parent families*-Controlling for mom education, mom & dad age, & occupation prestige, children whose fathers have more prestigious occupations & are enrolled in high quality DC[6] have higher PPVT-R scores. *1 parent families*-Controlling for mom age, mom education, & occupational prestige, children whose mom were older & are enrolled in high quality DC[6] have higher PPVT-R scores. Children w/ high vocabulary scores are in high quality care & come from highest SES[7] levels. One parent families, children w/ high vocabulary scores are in high quality DC regardless of SES[7].
Vernon-Feagans, Emanuel, & Blood (1997)	67	24 mos		Hi & Low quality defined by a composite of C:A ratio, group size, & CG training	All middle income, dual earner, white households	Sequenced Inventory of Communiction Development (SICD)	Poor quality child care associated with poorer expressive language scores. Poorest scores were obtained when poor quality care coupled with chronic Otitis Media.
Volling, & Feagans (1995)	36	18-24 mos		C: A Ratio[3], Group size	Child's Age, Age of entry, Hours/week in care	IBQ: (Temp) TBAQ & Vandell & Powers Quest: (Soc Comp)	Controlling for child's age & age of entry, higher C:A ratios[3] predicted more nonsocial play and less positive adult interactions. Controlling for child's age & hour/week in care, predicted more nonsocial play and less positive adult interactions. Child's temperament (social fear) interacts w/ quality of care. High quality care make act as a buffer for socially fearful children in positive peer interactions & nonsocial play w/ peers.

Note:
*Full references are available in reference section.

[5]**QUALITY MEASURES ALPHABATIZED BY ACRONYM: COF**: Child Observation Form; **DCEI**: Day Care Environment Interview; **DCHERS**: Day Care Home Environment Rating Scale; **ECERS**: Early Childhood Environment Rating Scale; **ECOI**: Early Childhood Observation Instrument; **ECOS**: Early Childhood Observation Scale; **FDCRS**: Family Day Care Rating Scale; **ITERS**: Infant-Toddler Environmental Scale

[4]**CHILD DEVELOPMENTAL OUTCOME MEASURES ALPHABATIZED BY ACRONYM: AQS**-Attachment Q-Set; **Adult-Child IRS**: Howes & Stewart's Adult-Child Involvement Rating Scale; **ALI**: Adaptive Language Inventory; **BSQ**: Behavior Style Questionnaire; **CBI**: Classroom Behavior Inventory-Preschool Form; **CBS Q-Sort**: Child Behavior Survey, Q-Sort version; **CPS**: Cognitive Play Scale; **CSBS; EOWPVT**: Expressive One-Word Picture Vocabulary Test; **Harter**: Pictorial Scale of Perceived Competence and Social Acceptance for Young Children; **MDI**: Mental Developmental Index; **PBC**: Preschool Behavior Checklist; **PBQ**: Preschool Behavior Questionnaire; **PLAI**: Preschool Language Assessment Instrument; **POS**: Play with Objects Scale; **PPS:** Peer Play Scale; **PPVT-R**: Peabody Picture Vocabulary Test-Revised; **PSI:** Preschool Inventory-Revised; **SCS**: Social Competence Scale; **SICD**: Sequence Inventory of Communication Development; **SSPS**: Spivack & Shure's Social Problem Solving Skills; **TBAQ**: Toddler Behavior Assessment Questionnaire

[1]**CG**: Caregiver, [2]**ECE**: Early Childhood Education, [3]**C:A Ratio**: Child-Adult Ratio, [4]**Exp**: Experience, [5]**CC**: Child Care, [6]**DC**: Child Development, [7]**SES**: Socioeconomic Status

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Table 3

LONG-TERM ASSOCIATIONS BETWEEN CHILD CARE QUALITY AND CHILD DEVELOPMENTAL OUTCOMES

CITATION	N	AGE	PROCESS QUALITY MEASURE	STRUCTURAL QUALITY MEASURE	OTHER CHILD CARE MEASURES	FAMILY CONTROLS	CHILD DEVELOPMENTAL OUTCOMES	QUALITY FINDINGS
Blau (1999 c)	Not specified	variable	None	Mother report of group size, C:A Ratio, CG training;	Type of care, no. of arrangements, hours, cost	Mode of Care (CC control)	BPI (Behavior Problems Index) PIAT (math & reading achievement) PPVT (language)	See text
Broberg et al. (1990)	84 children in Sweden	Time 1 =prior to care; M age = 16 mos. Time 2 = 1 yr later; Time 3 = 2 years later	Pos & neg events (Belsky & Walker Spot observ checklist	None	Type of Care	Social status, quality home envir, parents perceived social support, child temperament, child sociability	Griffith's Developmental Scales-Scale C (Verb/Ling ability at 28 mos and 40 mos)	ANOVA: no care group difference in verbal abilities at 28 or 40 months PLS:- no effect of child care quality nor type of care on verbal ability at 28 or 40 months.
Broberg et al. (1997)	Initial sample of 146 was recruited at 12-24 mos. 123 assessed at 8 yrs. 123		Composite: Adult Child interact – 16, 28, 40 mos	Composite: C:A Ratio', # hrs in care per day: 16, 28, 49 mos	Time in child care	Social status, inhibition, paternal involvement, home environment	Griffith's Developmental Scales-(Lang Subscales) Standardized School Readiness Test (numerical subscales)	Struct qual related at 40 mos (.30*) & 80 mos (.22*) w/ math 2nd grades. Verbal in 2nd predicted by (1) verb at 40 & 80 mos, (2) # mos in CC, (3) consistent high paternal involvement Math in 2nd pred by (1) mat at 80 mos, (2) struct qual, (3) inhib scores, (4) process qual. Not predicted by # sibs, gender, qual home. SES not entered in equation.
Burchinal et al. (in press)	89	Recruited in first yr; Reassessed at 12, 24, & 36 mos.	ITERS, ECERS	C:A Ratio', Group size, Teacher education		Child age, child Gender, poverty status, home environment	Bayley (Cog: 12, 24, 36 mos) Lang: Receptive & Express (vocab) Communic Skills (12, 24, 36 mos; Communicative, Social Affective, Symbolic Skills (12, 18, 24 mos)	Quality care increased linearly b/w 12 & 36 mos 12 mos concurrent: process quality related to cognitive skills, receptive language, overall communication C:A Ratio' & group sized related to overall communication. HOME related to cognitive & overall communication. 24 mos (concurrent): Process quality related to cognitive skills, receptive language, expressive language, & overall communication skills. Structural not related. HOME related to overall communication. 36 mos (concurrent): process qual related to cog, recept & express lang. Ratio & Gp size related to cog skill, expressive lang. T. Ed related to express lang. HOME not related. HLM (separate for process qual, ratio, T ed) controlling for sex, poverty, HOME Process qual: higher qual over time related to better cog, recept lang, express lang, & overall communic skills. Assoc w/ expressive lang increase w/ age Ratio: related to higher scores over time on receptive lang & overall communic skills; & to rate at which express skills acquired. T. Educ: related to higher cog & receptive lang skills for girls only

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Table 3, continued

Chin-Quee & Scarr (1994)	127	Recruited preschool, follow-up 5-9 yrs	ECERS Amount & Type of Verbal Interact b/w Child & CG[1]		Childs experiences in CC[5], Age of entry into CC[5], # Hrs. Attendance	Maternal Education & Maternal IQ (PPVT-R), Values Conform, Value Soc Skills	Report Cards (Social & Cog Dev) Teacher report peer relations, cooperative beh, Acad Achieve	HMR: (1) mat ed, mat IQ, values conform, values soc skills; (2) CC Exper: Age began care, Total time in care; (3) Quality: ECERS Quality of Care in infant & preschool yrs→NOT related to school age outcomes HMR: (1) same; (2) same; (3)Prop control utterances, Prop expressive utterance Quality indicators(prop control & express utter) failed to predict school age outcomes
Deater-Deckard, et al. (1996)	141	Time 1 = toddler or preschoolerTime 2 = 4 yrs later	Composite of ITERS, ECERS, Profile, CG education, wages	C:A ratio		SES, child sex, child age, parenting stress, harsh parental discipline	Composite scores of mother-reported behavior problems and social withdrawal and teacher-reported behavior problems and social withdrawal	No significant correlations between Time 1 process quality and Time 2 child outcomes or between Time 1 C:A ratio and Time 2 child outcomes Also Time 1 process quality and C:A ratio did not predict Time 2 outcomes in hierarchical regressions that controlled for Time 1 adjustment.
Field (1991) Study 1	28	5-8 yrs in full time care by 2	Not assessed **All high qual**	C:A Ratio[3] CG[1] education CG[1] stability	Amount time in care	Maternal extraversion→ child outcome	BRS: (Sociability, Socioemot Adj) Piers-Harris (Self-Concept) Buck I/E scale	Partial correlations (maternal extraversion): amount time spent in high qual, stable care & later adjust (5-8) associated w/ all child outcomes.
Field (1991) Study 2	56	6[th] grade (M = 11.5) full time care by 2	Not assessed **All high qual**	C:A Ratio[3], CG[1] education, CG[1] turnover	Amount time in care	No family variables associated w/ time in care	BRS (socioem adjust & sociability) Piers-Harris (Self-Concept) Peer Interac: Beh Acad Meas: gifted prog, lang arts, math grades	Simple correlations: amount of time in high quality programs. Stable care & later adjustment at 6[th] grade Amount of time in high quality care associated with all child outcomes.
Hagekull & Bohlin (1995)	52 Swedish children	Recruited at 6 wks until 4 yrs	Stimulation Emotional Tone b/w Adults & Children	C:A Ratio[3], Group Size, CG[1]: Child-oriented Education & Experience, Security Aspects, Available Space	Overall rating of quality of care includes both	SES[7], overall quality of home, child gender, temperament (10, 15, 20 mos)	TBQ PBQ Hagekull & Bohlin: Ego Strength/ Effectance & Soc Comp	29 mos (concurr): observed day care quality→ maternal report positive emotional expression 4 yrs (long): observed day care quality --> aggregated reports internalizing problems & ego strength/effectance HMR: 29 mos: children from low quality homes, in good qual DC[6]→reduction in externalizing behaviors. Children from medium or high quality homes, DC[6] quality not important in explaining externalizing behaviors 4 yrs: Children, low SES[7], in good quality care → less aggressive, no effect on higher SES[7] (2) aggressiveness of easy children positively affect by high quality DC[6]. Difficult children no decrease in aggressiveness in high quality setting (3) for boys, good qual care associated w/ less internalizing/ social withdrawal problems & more ego strength/effectance
Howes (1988)	87	45-57 mos followed for 2 yrs		CG[1] training in child development, small group size, low C:A Ratio[3], planned & indiv educ prog, adeq physical space	Age of entry Length of day # diff arrangements	Maternal education, family struct maternal employ	Academic progress (1[st] grade CG[1] report) CBP: (Behavior Problems, School Skill)	HMR: (1) family characteristics (2) CC[5] char Higher child care quality predicted: (1) better acad skills for boys only (2) better social skills both girls & boys (3) fewer behavior problems both girls & boys smaller # arrangements→better academic skills for boys & girls

Table 3, continued

Howes (1998)	80 children	45 center care b-4 1 yr other full time between 1 & 4	CG involvement/ investment in child compliance (toddler period: 18, 24, 30, 36 mos)	Composite: C:A Ratio*, CG^1 training, CG^1 stability (toddler period)		Family social Family structure Child Age	CBCL CBI	Structural Quality– concurrent (toddler) M.E.: High quality→ more compliant at care, more self-regulation in lab. Longit (Preschool): M.E.: high quality→ more social pretend play, more positive affect, less CG^1 rated difficult. Longit (Kindergarten): high quality→less CG^1 rating of hostility Process Qual (Long), age partialled out: Preschool: CG^1 involvement/investment→observed social play, social pretend play, positive affect, less CG^1 rate difficult & hesitant. Kindergarten: CG^1 involvement→ less parent ratings of internalizing & externalizing; less CG^1 rate of distract, hostile; higher rate verbal IQ, consideration See summary sheet for further analyses
Jacobs & White (1994)	36 c Kind, 4 yrs at recruit 32 Kind, not enrolled	Kindergarten	ECERS	None		SES*	PPVT-R (Recept lang) SSC: (Social)	MANOVAs (same results w/ no covar & w/ SES & PPVT cov) children in center care higher on interest-participation than children in no-care, no difference b/w high & low quality care no care effect on cooperation-compliance children in high-quality center highest on receptive language, followed by no care & then low quality
NICHD (1998) ECCRN	1,085 1,041	24 & 36 mos	ORCE: positive caregiving rating at 6, 15, 24, and 36 mos		Quantity, entry age, stability, group type	Income/needs, psych adjust, c. gender, c. temp	Mother reported behavior problems & social competence; caregiver report of problems; laboratory observations of compliance & negativity	C. in higher qual child care during 1^{st} 3 yrs→ more compliant & cooperative during observations; CG reported fewer behavior problems
NICHD (in press-b) ECCRN		6, 15, 24, 36 mos	Positive CG^1 composite, Language stimulation		Quantity, type	Maternal PPVT-R, child gender, HOME & maternal stimulation	Bayley MDI, Bracken School Readiness, Macarthur CDI, Reynell Dev Lang	Positive caregiving & language stimulation significantly related to cognitive & language outcomes at 24 & 36 mos HMR: 1) selection variables, 2) child gender, 3) family envir, 4) quantity & type of care, 5) positive caregiving (PC), 6) frequency of language stimulation (LS) – see summary sheet Cognitive & Lang predicted by Process qual at 15, 24, 36 mos Lagged effects: Cog: at 24 mos only concurr LS pred Lang (express) at 24 & 36, c. w/ higher LS earlier assess better scores. Lang (receptive) at 36 mos, predicted pos by earlier LS
NICHD (submitted) ECCRN	669 612	24 & 36 mos	Positive Caregiving (ORCE)		Amt time in CC^2 Available other Children	Maternal education, maternal attitude toward employment, child gender, cog/ ling perf at 24 & 36 mos, mat sens in play, mat psych adjus, fam struc # c in home)	Mother and caregiver report of peer competencies; observed peer interaction in child care and structured task.	**24 mos:** More Positive Caregiving→Child more positive sociability at 24 mos, lower proportion negative interaction w/ peers observed.

Table 3, continued

Peisner-Feinberg et al. (1999)	826-year 1 157-year 2 463-year 3 418-year 5	4.3 (year 1) 5.1 (year 2) 6.0 (year 3) 8.0 (year 5)	ECERS, CIS, UCLA ECOF, AIS, PPS, IEOS, STRS	CG[1] education, CG[1] exper[4], gender, ethnicity, beliefs		Maternal education, child gender, child ethnicity	PPVT-R, WJ-R (letter-word, math), CBI, ASB	--Children who attended CC[5] w/ higher quality classroom practices had better language & math skills from the preschool years into elementary school. --Children w/ closer CG[1]-child relationships in CC[5] had better classroom social & thinking skills, language ability, & math skills from the preschool years into elementary school. --Better quality CC[5] was more strongly related to better math skills & fewer problem behaviors from the preschool years through second grade fro children whose mothers had less education
Pierrehumbert et al. (1996)	47 Swiss	1-5, recruited 3-9 mos	Positive Contact (Ainsworth interactive scale)	None		SES[7], child gender, attachment w/ mom, positive contact w/ mom	Developmental Quotients WPPSI CBCL	Attach security, SES, & positive contact w/ CG[1] predicted increase in cognitive index between 2 & 5 years
Vandell et al. (1988)	20	Obs at 4 & at 8 yrs	None	C:A Ratio[3], Group size, space, materials available, CG[1] education		Family struc, age of entry in full-time care, family social class	PRS Harter PCS Parent Ratings socioemotional adjust (Santrock & Warshak)	HMR: 1) family social class 2) day care quality Better care quality→1) more friendly & fewer unfriendly interact; 2) higher observer ratings pos affect & social comp, & 3) fewer peer nominations of shy. No prediction of Parent ratings Partial Correlations (family social class partialled out) Positive interaction w/ adults at 4 yrs = 8 year social competence, peer acceptance, empathy, conflict negotiation, impulse control Unoccup behs at 4 yrs = 8 yr less social comp, conflict negotiation, reaction to frustration, peer acceptance
Vernon-Feagans, Emanuel, & Blood (1997)	67	Recruited before age 1, followed until 4		Adults present (C:A Ratio[3]), group size			SICD: (Receptive & Expressive Language)	Children in high quality centers→better expressive language & receptive language.

Note.

[a]Full references are available in reference section.

[b]**QUALITY MEASURE ACRONYMS ALPHABATIZED: AIS**: Adult Involvement Scale, **CIS**: Caregiver Interaction Scale; **ECOF**: UCLA Early Childhood Observation Form; **ECERS:** Early Childhood Environment Rating Scale; **ECOI**: Early Childhood Observation Instrument; **IEOS**: Instructional Environment Observation Scales; **ITERS**: Infant-Toddler Environmental Scale; **ORCE**: Observational Record of the Caregiving Environment; **STRS**: Student-Teacher Relationship Scale

[c]**CHILD DEVELOPMENTAL OUTCOME MEASURE ACRONYMS ALPHABATIZED: ASBI**: Adaptive Social Behavior Inventory; **ASB**: Teacher Assessment of Social Behavior; **BCL**: Behavior Checklist; **Boehm:** Test of Basic Skills; **BPI**: Behavior Problems Index; **BRS**: Behavior Rating Scale; **BSQ:** Behavior Screening Questionnaire; **Buck I/E Scale**: Buck Internalizer/Externalizer Scale; **CBCL**: Child Behavior Checklist; **CBI**: Child Behavior Inventory; **CBP**: Child Behavior Profile; **CTBS**: Comprehensive Test of Basic Skills; **MacArthur CDI**: Communication Development Inventory; **MDI**: Mental Development Index (Bayley II); **MSCA**: McCartney Scale of Children's Abilities; **ORCE**: Observational Record of the Caregiving Environment; **PBQ**: Preschool Behavior Questionnaire; **PEI**: Parent as Educator Interview **PIAT**: Peabody Individual Achievement Test; **PPS**: Peer Play Scale; **PPVT-R**: Peabody Picture Vocabulary Test-Revised; **PRS**: Peer Relations Scale; **RCSA**: Rutter Child Scales (A & B); **SCS**: Social Competence Scale; **SICD**: Sequence Inventory of Communication Development; **SRA**: Science Research Associates Achievement Battery; **TBQ:** Toddler Behavior Questionnaire; **WJ-R**: Woodcock-Johnson Tests of Achievement-Revised

[1]**CG**: Caregiver, [2]**ECE**: Early Childhood Education, [3]**C:A Ratio**: Child:Adult Ratio, [4]**Exp**: Experience, [5]**CC**: Child Care, [6]**DC**: Child Development, [7]**SES**: Socioeconomic Status

TABLE 4
Linear Trends Relating Number of Recommended Standards Met to Child Outcomes: NICHD Study of Early Child Care

	Adjusted Mean by No. of Standards Met					Linear Trend	
	0	1	0	2	3	F	P
24 months							
No.	15	38	65	29	16		
Mental development, mean (SE)	95.4 (3.0)	93.8 (1.9)	97.2 (1.5)	98.6 (2.2)	99.7 (3.0)	2.19	.14
Behavior problems, mean (SE)	0.34 (0.86)	-0.12 (0.54)	-0.19 (0.41)	-0.40 (0.62)	-2.17 (0.84)	4.18	.04
Positive social behavior, mean (SE)	0.31 (0.41)	-.02 (0.26)	0.16 (0.20)	0.74 (0.30)	0.86 (0.40)	2.25	.14
36 months							
No.	8	31	65	60	86		
School readiness, mean (SE)	36.1 (8.0)	38.9 (4.1)	47.9 (2.8)	51.5 (2.9)	51.8 (2.4)	6.29	.01
Expressive language, mean (SE)	92.3 (4.7)	98.6 (2.4)	95.8 (1.6)	101.4 (1.7)	100.2 (1.4)	3.34	.07
Language comprehension, mean (SE)	95.6 (4.5)	99.1 (2.3)	100.1 (1.6)	105.0 (1.6)	104.7 (1.4)	6.03	.02
Behavior problems, mean (SE)	2.69 (1.25)	0.81 (0.63)	0.31 (0.43)	0.04 (0.45)	-1.14 (0.38)	9.59	<.01
Positive social behavior, mean (SE)	-0.14 (0.60)	0.06 (0.30)	-0.10 (0.21)	0.14 (0.22)	0.27 (0.18)	0.47	.49

Note. Family income-to-needs ratio and maternal sensitivity were used as co-variates.

TABLE 5

Adjusted Means for Children in Settings That Did or Did Not Meet Specific Child Care Standards: NICHD Study of Early Child Care

	Child-Staff Ratio		Group Size		Caregiver Education		Caregiver Training	
	Met	Not Met	Met	Not Met	Met	Not Met	Met	Not Met
24 months								
No.	43	120	45	118	38	125	57	106
Mental development								
Mean	99.26	95.82	97.87	96.29	97.00	95.84	97.63	95.06
SE	1.78	1.06	1.75	1.08	1.06	1.96	1.14	1.57
Behavior problems								
Mean	-1.54	0.07**	-0.09	-0.15	-0.30	-0.55	-0.51	-0.07
SE	0.50	0.30	0.50	0.31	0.30	0.56	0.33	0.45
Positive social behavior								
Mean	0.79	0.13*	0.47	0.24	0.33	0.20	0.39	0.15
SE	0.24	0.14	0.24	0.15	0.14	0.27	0.16	0.21
36 months								
No.	140	110	157	93	201	49	187	63
School readiness								
Mean	49.77	47.12	49.23	47.56	51.06	38.52***	51.09	41.22**
SE	1.92	2.17	1.82	2.37	1.57	3.19	1.64	2.82
Expressive language								
Mean	99.96	97.60	99.60	97.77	99.63	96.01	99.40	97.48
SE	1.11	1.25	1.05	1.37	0.92	1.88	096	1.66
Language comprehension								
Mean	103.81	101.02	103.21	101.52	103.50	98.81*	104.03	98.27**
SE	1.07	1.21	1.02	1.33	0.89	1.81	0.92	1.58
Behavior problems								
Mean	-0.66	0.57**	-0.32	0.23	-0.51	1.49***	-0.41	0.76*
SE	0.30	0.34	0.29	0.37	0.25	0.50	0.26	0.45
Positive social behavior								
Mean	0.31	-0.16*	0.11	0.09	0.13	0.01	0.11	0.09
SE	0.14	0.16	0.13	0.17	0.12	0.24	0.12	0.21

Notes: At 36 months, the ratio standard was 7.1, the group size standard was 14, the caregiver education standard was some college, and the caregiver training standard was some post-high school training in child development, early childhood education, or a related field. Pairs of means shown in italics were significantly different from one another. Child outcomes and child care standards were measured concurrently.

*p<.05; **p<.01; ***p<.001

TABLE 6
Summary of Effect Sizes at 36 Months: NICHD Study of Early Child Care

	Child Care Quality[1]		Hours in Care[2]		Home Quality[3]	
	Whole Sample r	Extreme Groups[4] d	Whole Sample r	Extreme Groups[4] d	Whole Sample r	Extreme Groups[4] d
School Readiness	.14***	.39***	.00	.04	.25***	.83***
Expressive Language	.14***	.44***	.00	.04	.28***	1.01***
Receptive Language	.09***	.27*	.06	.10	.19***	.71***
Behavior Problem (Mother)	-.03	-.14	.05	.08	-.06	-.10
Positive Social Behavior (Mother)	.03	.13	.03	.15	.18***	.55***
Behavior Problems (Caregiver)	-.06	-.25	.04	.12	-.15***	-.56***
Peers Skills	-.04	-.05	.06	.06	.17***	-.57***

*p<.05; **p<.01; ***p<.001

[1]Associations between cumulative positive caregiving and child adjustment at 36 months, controlling for site, mother education, income-to-needs, mother psychological adjustment, home quality, child gender, percent time in centers, and hours in care.

[2]Associations between cumulative child care hours and child adjustment at 36 months, controlling for site, mother education, income-to-needs, mother psychological adjustment, home quality, child gender, percent time in centers, and child care quality.

[3]Associations between cumulative observed home quality and child adjustment at 36 months, controlling for site, mother education, income-to-needs, mother psychological adjustment, child gender, percent time in centers, hours in care, and child care quality.

[4]Extreme group analyses contrasted the bottom and top quartiles.

TABLE 7

Regression Results and Simulated Change in Child Cognition and Language Skills

Simulation: Shift in Quality One Standard Deviation below the Mean to One Standard Deviation above the Mean

	Positive Caregiving Rating†		Language Stimulation‡	
Quality Measure	Coefficient	Change	Coefficient	Change
15 months (N=595)				
Bayley	0.39	—	0.15*	4.79
CDI Vocab Prod.	1.21*	6.97	0.46*	14.53
CDI Vocab Compreh.	1.44*	8.30	0.32*	9.96
24 months (N=739)				
Bayley	0.78*	4.47	0.06*	3.91
CDI Vocab Prod.	0.64	—	0.20*	12.03
CDI Sentence Compreh.	1.21*	6.93	0.15*	9.24
36 months (N=856)				
Bracken	0.97*	6.39	0.08	—
Reynell Expressive Lang.	0.81*	5.30	0.12*	6.36
Reynell Verbal Compreh.	1.31*	8.62	0.06	—

Source: NICHD Early Child Care Research Network (in press-b).

Notes: Equations also include maternal ratings, income to needs, gender, HOME total score, maternal stimulation, average hours per week in childcare, number times in center care, number times in child care home.

†Reported for model which does not include language stimulation.

‡Reported for model which includes positive caregiving rating.

*Statistically significant at 5% level

TABLE 8
Studies of Child Care and Parental Employment

CITATION	STUDY DESIGN	ISSUE ADDRESSED	N	AGE	QUALITY MEASURE	POSSIBLE CONTROL	FINDINGS
Does Employment Matter?							
Blau, D. and P. Robbins, 1988. *"Child Care Costs, and Family Labor Supply."*	1980 Employment Opportunity Pilot Project (EOPP)	Mother does not work versus four combination of mother working with purchased care or not, other relatives working or not.	Married and single mothers	< 7	Average child care expenditures among families in the community who purchased care	The study averages child care expenditures across families within a given geographical location.	Uses multinomial logit estimation procedure. -0.38 (average price elasticity of employment over a range of examined child care costs) Significance cannot be determined from available information.
Blau, D and P. Robins, 1989. *"Fertility, Employment, and Child-Care Costs."*	Employment Opportunity Pilot Projects (EOPP)	An examination of employment, child care costs, births rates and potential behavior effects of child-care subsidies	6170 employed women and 8940 unemployed women			child care costs, wage rates, education, work experience, age	Child care costs are estimated to have significant effects on both birth and employment transition. Higher child-care costs are estimated to lower birth rates for unemployed women, but not for employed women. Higher child-care costs also increase the rate of leaving employment and reduce the rate of entering employment.
Brooks-Gunn, et al. 1994. In Ross, C and D. Paulsell, 1998. *"Sustaining Employment Among Low-Income Parents: the Role of Quality in Child Care: A Research Review."*	Infant Health and Development Program	Employment of Mothers	Mothers of low-weight pre-mature infants offered home visits		random assignment intervention		The provision of high-quality center-based care to low-income mothers of very young children can increase employment rates and improve the stability of employment over time. Cumulative months of employment for less-educated black mothers were 14.2 for the intervention group and 12.0 for the control group.
Connelly, R. and J. Kimmel, (2000)	1992 and 1993 SIPP	Examination of difference in the effect of child care prices on employment and child care mode choice by marital status.	Married and unmarried mothers (employed, full & part-time employed)			tax credits, subsidies, price of care, employment status	Using a single predicted price of child care married women working full or part-time were no different in their mode of child care choice. Single mothers working full-time were more likely to use center-based care. Estimating separate prices of care for each mode of care, married and single mothers working full-time were both more likely to use center care rather than relative care. Implications include a move towards increased center based care as more women increase full-time work as they reach welfare reform time limits.

TABLE 8, continued

CITATION	STUDY DESIGN	ISSUE ADDRESSED	N	AGE	QUALITY MEASURE	POSSIBLE CONTROL	FINDINGS
Fuller, et al., 1999 *"Variation in Poor Children's Home and Child Care Settings: Does Maternal Employment Matter?"*	2 waves 1997, 1998	Does maternal employment affect choice of child care and child development	948 single motherers entering new welfare programs in CA, CN, FL		Early Childhood Environment Rating Scale (ECERS), Family Day Care Rating Scale (FDCRS), Arnett scale, Child Observation System	maternal education, age, ethnicity, child age, high and low-income groups	Children of high and low-employment mothers spend just under 40 hrs/wk in child care. High employment group has established more stable child-care providers averaging 6.8 months in duration compared to 4.9 moths for low employment group ($p<.01$, n=272). Children of low-employment group were attending centers who scored higher on the ECERS compared to children of high-employment mothers ($p<.01$, n=133). Women with more work experience select center-based programs more frequently than low-employment mothers.
GAO, 1995	Urban Institute's 1990 National Child Care Survey and Low-Income Sub-study	Mother is employed or not	(see above)	(see above)	Examined mothers employed or not. Selectivitiy corrected predicted hourly costs from employed who purchase care		Probit estimation. -0.5 for poor mothers, -0.34 for near-poor mothers, and -0.19 for non-poor mothers (calculated at means).
Leibowitz et al. 1992	NLSY	Whether mother is employed when child is 3 mo. old and whether mother is employed when child is 24 mo. old	first time mothers	children at 3 months and 24 months	Subsidy available through state and federal income tax credits; assumes the woman works full-time at her predicted wage.	Variation among states and over time in state and federal income tax credits for child care	Greater tax credits increased early return to work (within 3 mo.) But had little effect on employment of women with older children.

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TABLE 8, continued

CITATION	STUDY DESIGN	ISSUE ADDRESSED	N	AGE	QUALITY MEASURE	POSSIBLE CONTROL	FINDINGS
Maume, D. 1991. *"Child-care Expenditures and Women's Employment Turnover."*	Longitudinal SIPP, Wave 5, 1985	Looking at employed women from 1985 and the effects of child care payments on employment.	1814 women 15-45 years old	at least one child < 13 yrs.		Employment status, child care costs, education & work history, income	Child care payments force women to choose between employment and exiting the work force. The level of child care payments has s significant effect on rates of quitting for mothers of pre-schoolers, but not school-age children. The effects of child care expenses on quitting does not vary by mother's wage. Low and middle-income women will reduce work force attachment as child care expenditures increase.
Meyers,M, I Ross, C and D. Paulsell, 1998. *"Sustaining Employment Among Low-Income Parents: the Role of Quality in Child Care: A Research Review."* 993. In	Longitudinal CA GAIN program	Child care arrangements and mothers employment	Mothers participating in the GAIN program				A mother's assessment of the safety of the child care arrangements and the trustworthiness of the provider were important predictors of whether she was active in job preparation activities or employment 1 yr later. Parent's assessment of the learning and social opportunities in child care were not significantly associated v'th the parent's job related progress. When child/caregiver ratios did not meet standards, mothers were twice as likely to drop out of the program.
Peisner-Feinberg, E.S. et al., 1999. *"The Children of the Cost, Quality, and Outcomes Study Go To School."*	Longitudinal Cost, Quality and Outcomes Study	Education of mother, child care quality, and the effect on child development	826 children	pre-school through 2nd grade	Survey, child/ classroom assessment, teacher-child relationship quality	Analysis controlled for effects of maternal education, child gender and ethnicity	For children with less highly educated mothers, better quality child care was strongly related to better math skills and fewer problem behaviors through 2nd grade.

TABLE 8, continued

CITATION	STUDY DESIGN	ISSUE ADDRESSED	N	AGE	QUALITY MEASURE	POSSIBLE CONTROL	FINDINGS
Does Income Matter?							
Bureau of Census, U.S. Dept. of Labor. "*Work and Family*" (1988)	Longitudinal (NLSY)	child care arrangements and mother's income and family earnings		≤ 5	The % of children in relative, non-relative, and center care		The majority of mothers with earnings ≤$10,000 use relative care (47.3%) Most mothers with earnings ≥$30,000 use non-relative care (46.8%) Families with total income ≤$10,000 use relative care 65.0%. Most families with total earnings ≥$30,000 also use relative care 34.7%.
"Child Care for Low Income Families Workshop" 1995	Longitudinal NICHD Study.	Low income families and choice of care	1,364 mothers	Data collection at ages 6-,15-, 24-,36-,42- mo. and 7 year birthday	ECERS		Higher levels of *non-maternal* income appear to be necessary for low-income families to puchase higher-quality care.
"Child Care for Low Income Families Workshop" 1995	Longitudinal National Child Care Survey, 1993	Low income children and continuity of care	430 households with income < $15,000	pre-school	Stability (number of arrangements)		24% of low-income children < 5 and 45% of low-income preschoolers in families headed by an employed single mother were in more than one arrangement on a regular basis.
"Child Care for Low Income Families Workshop" 1995	Longitudinal National Child Care Survey, 1993	Low income families and choice of care	4,400 households	children < 13 years	Type of child care setting		48% low-income (<$15,000) cared for by parent. Use of non-parental care varied greatly by household type and employment status of mother. Care by a relative for low-income preschoolers with single mother (26%), employed mothers (28%), and mothers in education and training programs (23%). Children under 5 in families headed by employed single mothers rely heavily on family day care (21%) and center-based care (27%).

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TABLE 8, continued

CITATION	STUDY DESIGN	ISSUE ADDRESSED	N	AGE	QUALITY MEASURE	POSSIBLE CONTROL	FINDINGS
Hofferth & Wissoker, 1999 1992. In *"Why and how Working Women Choose Child Care: A Review with a Focus on Infancy,"* 1999	Longitudinal NLSY	Income and choice of care		< 6			Higher income, measure both as total household income and as mother's hourly wage, are associated with a higher probability of choosing center care over sitter, father, or relative care.
Hofferth, S. and D. Wissoker. 1992. *"Price, Quality and Income in Child Care Choice."*	Longitudinal NLSY	Income and choice of care	971 mothers who used some form of non-maternal care as the primary arrangement.	< 6	multinomial and universal logit models		Mothers who earn more per hour and families who have higher incomes (other than mother's earning) are more likely to select center care over other mode. Subsidizing child care expenditure directly through vouchers. Reducing fees (reducing the price by 10% increases the use of center-based programs by 39% (ML) and 27% (UL). Reducing the price by 25% increases the use of center based programs by 114% (ML) and 77% (UL). Increasing tax credits increases the use of center-based programs (all else equal).
Hofferth, S. (1999) Child Care, Maternal Employment, and Public Policy	Longitudinal	Low-income families and choice of care		< 6 (sub-groups ≤ 2 and 3-5 yrs.)	Type of care		Higher proportions of children of middle-income use center care (38% of all children). There are significant differences in center care use between working poor (22%) and non-working poor (35%)
Kontos, et al, 1995. In *"Why and how Working Women Choose Child Care: A Review with a Focus on Infancy,"* 1999	concurrent	Income and choice of care			Child care setting		Mothers with a family income greater than $40,000 were the most likely to select regulated family day care and mothers with a family income of less the $20,000 were the most likely to select relative care.

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TABLE 8, continued

CITATION	STUDY DESIGN	ISSUE ADDRESSED	N	AGE	QUALITY MEASURE	POSSIBLE CONTROL	FINDINGS
NICHD. *"Poverty & Patterns of Child Care"* (1997)	Longitudinal (NICHD)	Type of care with and without income	1,281	< 15 mo	quality of care measured by: Home Observation for Measurement of the Environment (HOME) Inventory; Pos. caregiving freq.; pos. caregiving rating.	ethnicity, sex, children in family, mother's education, income -to-needs ratio	In some homelike settings, mother's education predicted some day care quality measure, but income differences accounted for the effects of education. **In both in-home care and child care homes, children living in poverty received care that scored significantly lower on most quality measures than children with incomes above poverty.** The pattern in centers showed a curvilinear relation between income and quality with children from poor families receiving care that scored higher than that received by children from near-poor families.
NICHD, *"Study of Early Child Care,"* (1997)	Longitudinal	Family income and child care usage	1,364 children				Families living in poverty (income needs ration 1.0) were less likely to use center care. Children in near poverty (income to needs ration between 1.00 - 1.99) received lower quality of center care than children in poverty. Family economics accounted for the amount, the age of entry into care and the type and quality of care infants received.
NICHD, *"Study of Early Child Care,"* (1999)	Longitudinal	Income and choice of care			In-home care and family day care		Families using in-home care had the highest income levels for maternal and non-maternal income. The mean non-maternal income was $20,000 higher than the means for families using any other type of care. Family income was a significant predictor of both the age at which infants entered care as well as the number of hours per week spent in care. 5 groups were compared based on age of entry into nonmaternal care (0-2 mo, 3-5 mo, 6-11 mo, 12-15 mo, not in care at 15 mo.) The families of infants who entered care between 3 & 5 mo. had the highest incomes. Maternal income was greatest in this group. Infants who entered care between 0-2 mo. had families with low nonmaternalt incomes - they were more dependent on maternal incomes. Families whose infants were not in care at 15 mo. had relatively high nonmaternal incomes.

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TABLE 9

Ratings of Process Quality by Type of Care and Child Care: NICHD Study of Early Child Care

Distributions of Positive Caregiving Scores

(percentages)

	Poor	Fair	Good	Excellent
15 Months				
Child care homes	7.0	43.5	33.5	16.0
Centers	10.2	61.7	23.4	4.7
All types	7.7	43.2	34.2	14.9
Extrapolated U.S. care (nonparental)	9.0	44.4	34.9	11.7
24 Months				
Child care homes	8.5	50.2	27.5	13.7
Centers	11.4	66.3	18.5	3.8
All types	9.7	51.7	27.4	10.2
Extrapolated U.S. care (nonparental)	10.9	52.3	28.3	8.5
36 Months				
Child care homes	2.4	63.1	29.2	5.4
Centers	4.4	61.9	30.3	3.4
All types	3.9	59.5	31.5	5.1
Extrapolated U.S. care (nonparental)	4.3	60.6	30.2	5.0
15-36 Months (mean)				
All types imputed	7.2	52.7	30.6	9.5
Extrapolated to U.S.	8.1	53.2	29.6	9.0

TABLE 10
Requirements for Child: Staff Ratio and Group Size By State

States	Age of Children			
	9 months	18 months	3 years	4 years
Alabama	6:1	8:1	12:1	20:1
	6	8	12	20
Alaska	5:1	6:1	10:1	10:1
	NR	NR	NR	NR
Arizona	5:1/11:2	6:1/13.2	13:1	15:1
	NR	NR	NR	NR
Arkansas	6:1	9:1	12:1	15:1
	NR	NR	NR	NR
California	4:1	6:1	12:1	12:1
	NR	12	NR	NR
Colorado	5:1	5:1	10:1	12:1
	10	10	20	24
Connecticut	4:1	4:1	10:1	10:1
	8	8	20	20
Delaware	4:1	7:1	12:1	15:1
	NR	NR	NR	NR
District of Columbia	4:1	4:1	8:1	10:1
	8	8	16	20
Florida	4:1	6:1	15:1	20:1
	NR	NR	NR	NR
Georgia	6:1	8:1	15:1	18:1
	12	16	30	36
Hawaii	4:1*	6:1*	12:1	16:1
	8	12	NR	NR
Idaho	6:1	6:1	12:1	12:1
	NR	NR	NR	NR
Illinois	4:1	5:1	10:1	10:1
	12	15	20	20
Indiana	4:1	5:1	10:1	12:1
	8	10	NR	NR
Iowa	4:1	4:1	8:1	12:1
	NR	NR	NR	NR
Kansas	3:1	5:1	12:1*	12:1*
	9	10	24	24
Kentucky	5:1	6:1	12:1	14:1
	10	12	24	28

TABLE 10, continued

States	Age of Children			
	9 months	18 months	3 years	4 years
Louisiana	6:1	8:1	14:1	16:1
	NR	NR	NR	NR
Maine	4:1	5:1	10:1	10:1
	12	15	30	30
Maryland	3:1*	3:1*	10:1	10:1
	6	9	20	20
Massachusetts	3:1/7:2	4:1/9:2	10:1*	10:1*
	7	9	20	30
Michigan	4:1	4:1	10:1	12:1
	NR	NR	NR	NR
Minnesota	4:1	7:1	10:1	10:1
	8	14	20	20
Mississippi	5:1	9:1	14:1	16:1
	10	10	14	20
Missouri	4:1	4:1	10:1	10:1
	8	8	NR	NR
Montana	4:1	4:1	8:1	10:1
	NR	NR	NR	NR
Nebraska	4:1	6:1	10:1	12:1
	NR	NR	NR	NR
Nevada	6:1	8:1	13:1*	13:1*
	NR	NR	NR	NR
New Hampshire	4:1	5:1	8:1	12:1
	12	15	24	24
New Jersey	4:1	7:1	10:1	15:1
	20	20	20	20
New Mexico	6:1	6:1	12:1	12:1
	NR	NR	NR	NR
New York	4:1	5:1*	7:1*	8:1*
	8	10	14	16
New York City	4:1	5:1	7.5:1	12:1
	8	10	15	20
North Carolina	5:1	6:1	15:1	20:1
	10	12	25	25
North Dakota	4:1	4:1	7:1	10:1
	NR	NR	NR	NR
Ohio	5:1	7:1	12:1	12:1
	12	14	24	28

TABLE 10, continued

States	Age of Children			
	9 months	18 months	3 years	4 years
Oklahoma	4:1 8	6:1 12	12:1 24	15:1 30
Oregon	4:1 8	4:1 8	10:1 20	10:1 20
Pennsylvania	4:1 8	5:1 10	6:1 20	6:1 20
Rhode Island	4:1 8	6:1 12	9:1 18	10:1 20
South Carolina	6:1 NR	6:1 NR	13:1 NR	18.1 NR
South Dakota	5:1 20	5:1 20	10:1 20	10:1 20
Tennessee	5:1 10	7:1 14	10:1 20	15:1 20
Texas	4:1/10:2 10	9:1/18.2 18	17:1/34:2 34	20:1/35:2 35
Utah	4:1 8	4:1 8	12:1 24	15:1 30
Vermont	4:1 8	4:1 8	10:1 20	10:1 20
Virginia	4:1 NR	5:1 NR	10:1 NR	12:1 NR
Washington	4:1 8	7:1 14	10:1 20	10:1 20
West Virginia	4:1 NR	4:1 NR	10:1 NR	12:1 NR
Wisconsin	4:1 8	4:1 8	10:1 20	13:1 24
Wyoming	5:1 NR	5:1 NR	10:1 NR	15:1 NR

NR means Not Rated.

Information was obtained from a 1999 report prepared by The Center for Career Development in Early Care and Education at Wheelock College.

TABLE 11

Regression Results for Period and Cumulative Effects at 24 and 36 Months:

	Mean	Standard Deviation	Coefficient Same Period Only	Coefficients Cumulative	Impact-1SD to +1 SD	Impact-1SD to +1 SD
CDI VOCABULARY PRODUCED †						
24 mo.: language stimulation	58.62	30.92	0.178	0.338	11.027	20.91
15 mo.: language stimulation	26.51	15.79		0.30		9.36
24 mo.: positive caregiver rating	3.96	2.87				
6–15 mo.: positive caregiver rating	14.63	2.89				
Total					11.027	30.27
Reynell: Vocabulary Comp.						
36 mo: language stimulation	50.56	27.09		-0.115		-6.25
15–24 mo.: language stimulation	58.62	30.92		0.195		12.08
36 mo.: positive caregiver rating	19.5	3.29	0.133	0.787	0.87	5.18
5–24 mo.: positive caregiver rating	13.96	2.87				
Total					0.87	11.00

Source: NICHD, 1999b.

Notes: Only variables that are statistically significant at 5% level are reported.

† Mean = 28.82

‡ Mean = 28.73

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TABLE 12
Descriptive Statistics for Child Care Standards at Four Ages: NICHD Study of Early Child Care

Feature	No.	Mean	SD	Minimum	Maximum	Recommended Level	Classes Meeting Recommended Level, %
			6 months				
Child-staff ratio	97	4.26	2.31	0.81	15.06	3	36
Observed group size	97	7.86	4.05	1.63	30.13	6	35
Caregiver training	97	1.70	1.55	0.00	4.00	2	56
Caregiver education	97	2.97	1.07	1.00	6.00	3	65
			15 months				
Child-staff ratio	118	4.14	1.30	1.50	7.88	3	20
Observed group size	118	8.53	3.28	2.38	23.38	6	25
Caregiver training	118	1.64	1.38	0.00	4.00	2	60
Caregiver education	118	2.89	0.89	1.00	5.00	3	69
			24 months				
Child-staff ratio	163	5.22	1.70	1.68	10.95	4	26
Observed group size	163	10.66	4.78	3.38	37.75	8	28
Caregiver training	163	1.84	1.37	0.00	4.00	2	65
Caregiver education	163	3.06	0.86	1.00	5.00	3	77
			36 months				
Child-staff ratio	250	6.98	2.32	1.92	14.90	7	56
Observed group size	250	13.20	4.63	3.50	32.63	14	63
Caregiver training	250	2.10	1.33	0.00	4.00	2	75
Caregiver education	250	3.24	0.91	1.00	6.00	3	80

Source. NICHD Early Child Care Research Network. 1999. "Child Outcomes When Child Care Center Classes Meet Recommended Standards of Quality," *American Journal of Public Health* 89: 1072–1077. Table 1.

TABLE 13

Marginal Effects of the Probability of Choosing among Modes of Care for the Youngest Child for Single Mothers (Multinominal Logit Estimation)

Variable	Relative Care	Home-based Care	Center-Based Care
Predicted Probability of full-time employment	-3.096*	-2.951**	6.046***
	(-1.91)	(-2.27)	(3.52)
Predicted wage	0.946*	1.000**	-1.947***
	(1.84)	(2.42)	(-3.60)
Education	-0.050*	-0.042*	0.093***
	(-1.72)	(-1.87)	(3.05)
State's average monthly AFDC payment per family	-6.E-4*	-2.E-4	9.E-4*
	(-1.84)	(-1.01)	(2.51)

Marginal Effects of the Probability of Choosing among Modes of Care for the Youngest Child for Single Mothers (Multinominal Logit Estimation Including Three Separate Predicted Prices of Child Care)

Variable	Relative Care	Home-based Care	Center-Based Care
Predicted Probability of full-time employment	-3.141***	-0.258	3.398***
	(-3.17)	(-0.37)	(3.34)
Predicted wage	1.095***	0.204	-1.299***
	(2.66)	(0.68)	(-3.13)
Education	-0.108***	0.043	0.151***
	(-2.81)	(-1.55)	(3.78)
State's average monthly AFDC payment per family	-6.E-4	3.E-4	3.E-4
	(-1.57)	(0.97)	(0.86)

Significance level: *10%, **5%, ***1%

Additional variables include: predicted price of care, predicted price of relative care, predicted price of home-care, predicted price of center-based care, age, nonwhite, non-labor income, youngest child is an infant, presence of other preschoolers, presence of children ages 6-12, presence of children ages 13-17, presence of other adults, urban residence, and state's average Medicaid expenditure per enrollee.

Source: Connelly and Kimmel (2000), Tables 5 and 6.